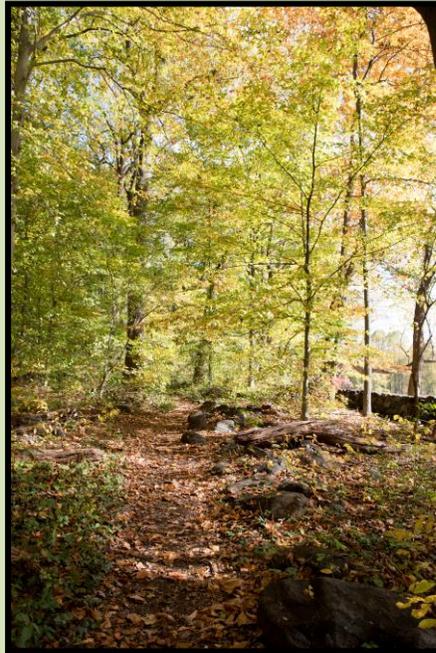


# Brandywine Creek State Park Trail Plan



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## Acknowledgements

Brandywine Creek State Park Trail Plan was guided and developed by the Division of Parks and Recreation's Trail Committee.

Division personnel with expertise in park management and operations, administration, enforcement, programming, environmental education, natural and cultural resource stewardship, trail construction, and planning led the development of the Brandywine Creek State Park Trail Plan. The following staff were engaged and collaborated in the development of the Brandywine Creek Trail Plan: David Bartoo, Rob Line, Chris Bennett, Susan Moerschel, Paul Nicholson, Becky Webb, Gary Focht, Angel Burns, Kendall Sommers, Thomas Kneavel, Eric Dawson, John McCarthy, Jim Hall, Lisa Watt, Eileen Butler, James Wagner, and Eric Gaberlein. Our neighbors and colleagues from the First State National Historic Park and the National Park Service Philadelphia Office participated in the planning process. Thank you to Russ Smith, Brooke Derr, David Lange, Ethan McKinley, Alan McLoughlin and Joy Pietschmann for making this process more robust.

Public participation was a core component in developing this plan. A Stakeholder Working Group, representative of trail and park user groups, was assembled to participate in open discussions regarding the development of the trail plan. Thanks to all the folks on the Working Group that participated in learning about the park's natural and cultural assets and recreational trail uses; learning about the Division's evaluation and planning process; and engaging in discussions that lead to the trail plan development. The Working Group provided key input for current and future alignments, surfaces, and uses represented in this plan. The Working Group members were Beverly Barnett, Bill Johnston, Bob Gaston, Dick Carroll, Gary Kirk, James Ireland, Jason Sparklin, Mary Everhart, Mike Monagle, and Dusty Burchnall.

Participation, engagement, and constructive dialogue contributed to a successful planning process and shaped the final trail plan. We extend our sincere appreciation to the Stakeholder Working Group, the attendees at the October 2015 Proposed Trail Plan Open House who attended and provided input, and the 226 citizens from around the region who responded thoughtfully to the Trail Plan Comment Form. The future of trails in Brandywine Creek State Park is bright because of your participation.



## Executive Summary

Brandywine Creek State Park and the associated recreational opportunities play a substantial role in creating a community that promotes exercise and makes access to the natural environment easy. The adjacent national park lands effectively double the size of available public land for recreation highlighting the importance of the state park as an integral component to an expanding regional equestrian, pedestrian, and bicycle trail network that will change how the greater Wilmington community and visitors to the region spend time and live better lifestyles.

During the trail planning process, existing natural and cultural resources were assessed and played an integral part in determining best trail locations resulting in alignments that achieve the following:

- Minimize impact to high quality habitats;
- Reduce habitat fragmentation;
- Reduce erosion;
- Protect cultural resources;
- Enhance and expand the [trail system](#);
- Create trail links between park management units;
- Build community connections where none exist today;
- Enhance diverse recreational experiences for all non-motorized trail visitors and;
- Consider the [essential experiences](#) for the park.

[Appendix A, Maps 1-7](#) highlight the existing conditions for the park in 2018. Based on the existing natural and cultural resources, including areas with wet soil conditions, and social science data, changes to the existing trail system are needed. Making recommendations for new trail alignments the DNREC Trail and Stakeholders Teams considered the following variables and conditions; trail safety; community connections; soil types; topography; hydrology; plant and animal distribution; current and future use; [habitat fragmentation](#); [erosion](#); [accessibility](#); experience; trail use trends; anticipated regional land use growth; park staffing levels; maintenance practices; challenge; and [trail sustainability](#). The planned trail system changes are highlighted in [Appendix A](#) on [Maps 9-16](#).

Brandywine Creek State Park's trails currently fall short of an acceptable threshold of the sustainability assessment criteria (see [Appendix C](#)). Analysis shows that of the 16.6 total trail miles, about 50% (8.4 miles) is in need of some degree of change or enhancement to achieve a higher level of sustainability (see [Map 2](#)).

Changes will slightly increase over-all mileages but significantly increase trail mileage for bikers and equestrians. Modifications from single use designated trails (pedestrian only) to more shared-use trails that include hiking, bicycling, and equestrian use is the key element for this change. Reconstruction of trails in perennially wet soil zones or high erosion areas will provide for the highest resource protection and sustainability. Current alignments that fall within [hydric soil](#) zones will be reviewed for [rerouting](#), [hardening](#), or the construction of boardwalks. These methods will avoid long-term impacts on natural and cultural resources and eliminate costly on-going [trail maintenance](#). Overall, alignment changes will account for an increase of 1.6 miles of trail.

A Summary of the planned trail changes are as follows:

- Existing 16.6 mile trail system will be increase by 10% or 1.6 miles
- Existing 9.2 miles of single track trail will be reduced by 3% to 8.7 miles through the elimination of unsustainable trail segments
- Double track will increase from 7.4 miles to 9.5 miles or 28% through the addition of new trails
- Realignments, enhancements, and new construction techniques of the existing 7.1 trail miles of poor trail sustainability will be reduced by 83% or 5.9 miles
- All-weather hardened surface trails will be increased by 18% or 0.6 miles
- 12.6 miles or 90% of designated Pedestrian Only trails will be re-designated as biking/pedestrian and biking/equestrian/pedestrian
- Accessible trails will increase by 138% or 2.2 miles



## Public Participation

The Division began a public participation process with a series of trail user stakeholder meetings in 2014. Trail Plan comments from the trail user community, advisory councils and public agencies were valuable in shaping this trail plan. Use of the Delaware's government web site for posting maps, information, and announcements made information more widely available for public review. On October 28, 2015, a public Open House was held at the Brandywine Creek State Park nature center to review the concept plan. Eighty four people attended the Open House and 226 responses to the draft Concept Trail Plan were submitted via an online comment form, email, and letter correspondence. Below is a summary of the responses (See [Appendix G](#) for a full review of the survey questions and analysis).

- 90% of the respondents supported the plan as proposed.
- 70% of the respondents used trail information such as trail markers maps, and information kiosks (most important amenities).
- 97% of the respondents live in the greater Newark/Wilmington Area
- 76% of the respondents use the park each month (53% each week).
- Seeking natural, narrow, challenging trails were reoccurring themes for all respondents.

Following the October 2015 Open House and comment period, the Division's Trail Committee evaluated all public comments to consider the following:

- How comments met Trail Plan objectives
- How comments fit into a larger regional trail system
- How potential recreational alternatives might contribute to regional recreation diversity
- How opportunities can be linked to larger trail systems.



## Regional and Local Trail Context

Brandywine Creek State Park (BCSP) is located in northern Delaware near the Pennsylvania boundary. See [Map 7](#) in [Appendix A](#) for regional context. It falls within the Piedmont [Ecoregion](#) – a region covering five percent of the State. Piedmont [geomorphology](#) is characterized by rolling hill topography, rocky soils, and steep stream valleys. BCSP hosts a variety of ecosystems including wooded uplands, freshwater wetlands, and open meadows. First State National Historical Park joins the Brandywine’s north boundary. To the west lie large residential lots, golf courses, and the Winterthur Museum and grounds. Areas east and south of the park are densely populated and in character with suburban and urban development. The Park lies west of the commercialized Route 202 corridor and is in close proximity to Wilmington, the state’s largest city.

Brandywine Creek State Park’s location places it close to major urban and suburban populations of Philadelphia metropolitan region-3.8 million people live within 30 miles of the park. The park’s 16.6 mile trail system combined with the trail miles in the adjacent First State National Historical Park make these public lands key recreational trail sites both locally and regionally.

### Trail Users and Uses

There was an estimated 182,500 visitors to Brandywine Creek State Park in 2015. Evidence shows that trail related recreation is one of the most popular activities in the park. From 2000 to 2010, the population of New Castle County grew from 538,170 to 554,405 residents, an increase of 3.0%. This increase and population projections for the next 30 years, place a high demand on Park resources in the future.

Below is a summary of the trail users observed in the Park.

- Pedestrians

The term pedestrian includes walkers, hikers, nature watchers, cross-country skiers, geocashers, and trail runners.

- Bicycle Riders

There are a number of sub groups that fall into this category. A few examples are road riders, commuters, competitors, mountain bikers, and general bicyclists who cruise paved pathway through town or at the beach.

- Equestrians

Equestrians include trail riding, mounted orienteering, endurance riding, carriage rides, and cross country jumping to name a few.

- Special Needs Populations

The Americans with Disabilities Act is a 1990 federal law that helps people with a disability gain equal access to public facilities. Presently there is guidance available for recreation facilities including trail widths of 3 feet or greater, grades of 10% and less, limited obstacles (no staircases or steps, or large roots or rocks), firm stable surfaces, and cross slopes 5% or less. Federal agencies (Forest Service and Park Service) are required to use these guidelines. The Delaware Division of Parks and Recreation uses the outdoor recreational accessible guidance. The guideline can be referenced at <http://www.fs.fed.us/recreation/programs/accessibility/>.

## Park Setting

The 952-acres of Brandywine Creek State Park contain a variety of landscapes, from river and stream valleys to meadows and hardwood forests (see [Appendix A](#) to view existing park conditions). Historically, the forests of the Piedmont were home to Native Americans, who harvested various foods from the forests and waterways and hunted game in the surrounding forests. After the European settlers arrived, agriculture developed slowly in the areas. The property that is now Brandywine Creek State Park has a long recorded history as a small family farm highlighting typical meadow and forested landscapes that have changed little over the last century.



## 2018 Trail System Condition Assessment

In the park today there are a variety of activities that impact trails and trail corridors. Trail location and park activities such as trail maintenance, ranger patrol activities, or trail users on foot, bike, or horse will impact the landscape and soils. Soil disturbance is expected in the development and use of trails, however better trail design and management can drastically reduce widespread trail impacts and erosion.

Today, the trail system at Brandywine Creek State Park is comprised of 16.6 miles of trail that serve hikers, walkers, runners, mountain bikers, bicyclists, equestrians, and other non-motorized trail users. This represents 11% of the total miles across the Delaware State Park trail system (see [Appendix B, Table 1](#)). Of those 16.6 trail miles in Brandywine Creek, 12.6 are designated as pedestrian-only, the remaining 4.0 miles are designated for equestrians, pedestrians and bike use (see [Table 2](#) below). [Table 3](#) below outlines trail characteristic by categories – accessibility, surface, widths, and permitted uses – and the percent that each characteristic represents in the trail system assessed in 2018. All existing conditions assessments are depicted in [Maps 1 through 6](#) (see [Appendix A](#)).

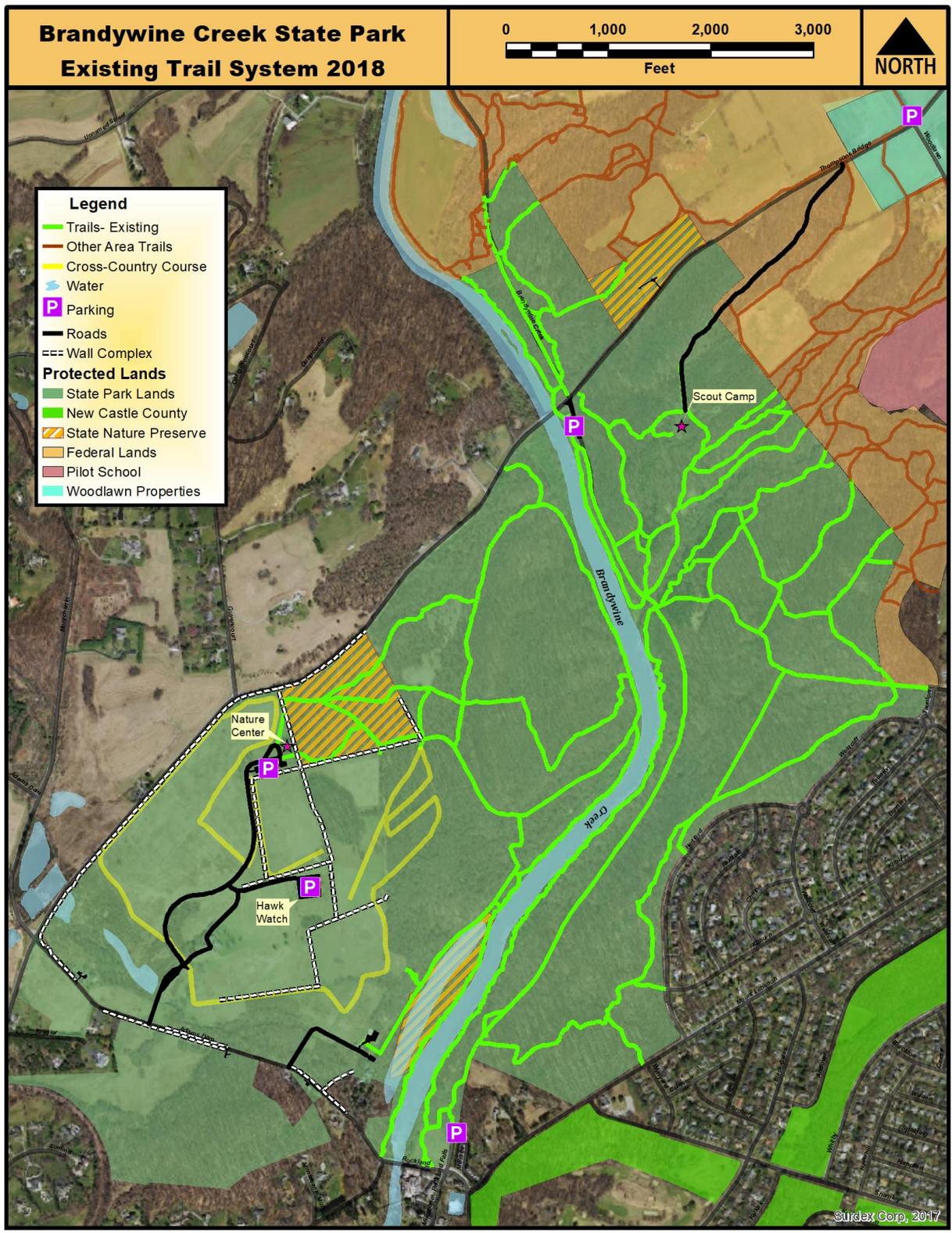
**Table 2 -  
2018 Trail Uses**

2018 Trail Uses	Mileage
Total Trails	16.6
Pedestrian	16.6
Pedestrian Only	12.6
Bike	3.5
Equestrian	2.7
Pedestrian/Bike	1.3
Pedestrian/Equestrian	0.5
Pedestrian/Bike/Equestrian	2.2

**Table 3 - 2018 Trail Characteristics**

Trail Characteristics	2018 Trail Mileage	Percentage of Park System
Total Mileage	16.6	100%
Surface		
Natural	13.3	80
Hardened	3.3	20
Width		
Single Track	9.2	55
Double Track	7.4	45
Permitted Use		
Pedestrian Only	12.6	76
Pedestrian/ Bike	1.3	8
Pedestrian/ Equestrian	0.5	2
Pedestrian/ Bike/Equestrian	2.2	12
Accessibility		
Accessible	1.6	10
Not Accessible	15.0	90

Map 1 - 2018 Trail System



## [Trail Descriptions](#)

Access to the trail system is available from several trailhead parking areas and nearby communities. There are six designated trails in the park.

- **Brandywine Trail**  
The 2.9 mile Brandywine Trail runs in close proximity to the east bank of Brandywine Creek. Trail users enjoy a gradually undulating crushed stone trail with beautiful views of the Creek. The trail is accessed from the Thompsons Bridge or the Rockland Falls Road Trailheads.
- **Creekside Trail**  
The 2.6 mile Creekside Trail, entirely within the flood plain, hugs the eastern bank of the Brandywine Creek. The trail runs from the north where the park boundary adjoins the National Park boundary to the south near Rockland Road trailhead. Not a contiguous trail, it connects to the Brandywine Trail in several places.
- **Hidden Pond Trail**  
The 1.6 mile trail begins at the Brandywine Creek Nature Center. Enter through the rock wall next to the Nature Center, then hike through the Tulip Tree Woods Nature Preserve. Forest will give way to open fields beyond the carefully crafted stone walls built by masons in the early 1900's. The trail surface is packed earth; the grade is gradual throughout most of the hike with steep grade changes as the trail approaches and leaves the banks of Brandywine Creek.
- **Indian Springs Trail**  
The Indian Springs Trail is a 1.8 mile long trail that begins behind the Nature Center in the Tulip Tree Woods Nature Preserve. Trail users experience rocky terrain and stunning views of Brandywine Creek and the elaborate stone walls within the park.
- **Longwall Trail**  
The Longwall Trail is a short linear 1.1 mile trail that highlights steep rocky slopes on the east side of the Brandywine River. It terminates on the north end at the Rocky run trail and at the south end at the Brandywine Trail. A local favorite, the trail is primarily natural surface, twisty, rocky, and very challenging.
- **Rocky Run Trail**  
Rocky Run Trail is a 1.8 mile long trail that can be accessed from the Thompson's Bridge trailhead. It has packed earth and paved surfaces. The trail winds through the east side of the Park through mature mixed steep-sloped rocky Piedmont forests.
- **Tulip Tree Woods**  
The Tulip Tree Woods Trail is a short 0.5 mile natural surface trail accessed from the nature center. The trail meanders through the Tulip Tree Woods Nature Preserve where visitors can experience first-hand the towering Tulip Trees, some more than 200 years old.

See [Table 4](#) for a complete listing of existing trails, mileage, and allowed uses.

**Table 4-** Existing Trails, Miles & Uses

Trail	Length in Miles	Pedestrian	Biking	Equestrian
Brandywine	2.9	√	√	√
Creekside	2.6	√		
Hidden Pond	1.6	√		
Indian Springs	1.8	√		
Longwall	1.1	√	√	
Rocky Run	1.8	√	√	√
Tulip Tree Woods	0.5	√		
Unnamed Trails	5.8	√	√	√

A series of maps depicting existing conditions for characteristics of the Brandywine Creek State Park’s trail network were developed to highlight specific trail attributes. Trail characteristics maps include existing 2018 trail system, trail environmental sustainability, permitted uses, width, and trail surfaces (See [Appendix A Map 1 - 6](#)). In 2018 the trail system was comprised of 16.6 miles of trail ([Map 1](#)). Of those miles, 7.1 miles or 43% of the trail fall into the “Poor” sustainability category and areas of improvement are identified that will result in higher level of sustainability. Permitted uses on park trails included pedestrian, biking and equestrian activities. Additionally, trails fall into two width categories – single and double track. In 2018 the trail system was comprised of 7.4 miles of double track, defined as widths greater than 36 inches and 9.2 trail miles of single track - widths 36 inches or less.

### Trail Infrastructure

Trail infrastructure includes bridges, trail wayfinding markers, information boards, and parking (See [Appendix A Map 6](#)). Currently visitors access Brandywine Creek State Park predominately by car. Three parking lots serve the majority of trail use. However there is off-site parking both within the First State National Historic Park and on private lands that connect to the regional [trail network](#). Several off-site trailhead parking lots help serve equestrian access for the area trails.

Trail wayfinding starts at the trailheads. Trailheads typically have an information board and state park map. Four-by-four posts with plastic over-sleeves are installed along trails at intersections

where there are directional trail choices. These trail marker posts contain information such as trail names, use, destinations, and latitude and longitude. Trail names have a color coding that corresponds to the same color used on park maps to highlight the specific trail. Maps are located at trailheads and on the Delaware State Park web site at [www.destateparks.com/activities/trails/maps.asp](http://www.destateparks.com/activities/trails/maps.asp).



*Typical Trailhead Information Board*



*Typical Trail Marking Post*



*Typical Trail Bridge*

## [Trail Plan](#)

### [Assessment Process](#)

In analyzing and assessing BCSP existing trail system, the Division evaluated changes made since the 1998 comprehensive trail data collection effort and determined progress made in achieving trail-related objectives. Geographic Information System ([GIS](#)) and field evaluations were used to assess factors and conditions that characterize Brandywine Creek State Park. GIS technology is valuable in discovering the relationship of trails within landscapes and habitat and an invaluable tool in moving from diagnosis to prevention, mitigation and enhancement.

GIS analyses, combined with field reviews, have revealed trail segments that fragment high quality habitat, are prone to erosion, and limit access. Habitat and natural heritage findings identified by both the Division's Stewardship Program and DNREC Natural Heritage and Endangered Species Program (NHESP) were examined within the context of the existing trail system. Trail relationships to forested blocks, ranked habitat quality, and natural heritage data revealed site specific impacts. Other analyses quantified the scale of trail system overlap with fall-line, floodplain, flat area and hydric soil conditions. Known and potential cultural resource sites were analyzed for their relationship to both the existing and planned trail system.

Analyses and recommendations outlined in this trail system plan for Brandywine Creek State Park are based on the principles of [sustainable trail design](#) and development and trail [best management practices](#) (See [Appendix C](#)). Using GIS tools and field review, resource experts determined impacts to natural resources, cultural resources, and to unsustainable trail conditions (fall-line, hydric soils, etc.) Subsequent Trail Plan sections outline the locations of new trail alignments. Areas of the Brandywine Creek will require trail reroutes, realignments, closures and new trail construction to continue to achieve the objectives outlined within this plan.

### [Sustainability](#)

Designing and constructing *sustainable trails* is paramount to protecting natural and cultural resources, providing great trail experiences, providing diverse recreational opportunities, and maintaining the life span of a trail system (see [Appendix C](#)). Trail sustainability is defined as the location of any given trail segment and how the segment relates to contours, drainage, and soil types, and, how well a trail segment withstands the impacts of weather and recreational use over time. The better a trail segment withstands these impacts, the more sustainable it is. Reducing impacts to natural resources such as native vegetation and wildlife and cultural resources are key Division [objectives](#) in trail planning.

Many trail management problems, erosion and user conflict for example, stem from poor trail planning, design, and construction. Ignoring best management trail design and construction practices results in accelerated trail degradation leading to an increase in maintenance costs and tasks as well as reduced trail user safety and enjoyment. While all trail users affect the trail surface and surrounding environment, user impacts rise when trails are poorly planned and constructed. The Division of Parks and Recreation adopted the principles of sustainable trail design and construction to ensure that trails remain accessible to users, valuable resources are protected, and future maintenance costs are minimized.

Current trail sustainability principles prescribe that all present and future impacts will not burden social, economic and environmental systems. Brandywine Creek State Park's trails currently fall short of an acceptable level of sustainability. The analysis of the Brandywine Creek State Park

shows that of the 16.6 total trail miles, about 50% (8.4 miles) is in need of some degree of change or enhancement to achieve a higher level of sustainability and environmental protection.

Designing a sustainable trail and trail system requires the analysis and evaluation of the following elements and factors:

- Cultural resources
- Endangered or sensitive plant and animal species
- Occurrence and health of native plants and animals
- Mature growth forests
- Quality of ecosystems
- Natural drainage
- Topography, slope and grade changes
- Ease of access from control points such as trailheads
- User safety
- Characteristics of trail users
- Accessibility
- Provide interesting experiences across the landscape.

Trails constructed over the past ten years in Delaware State Parks were planned according to sustainability objectives. Current practices adopted by the Division have proven that this planning method is very effective in minimizing the environmental effects of trails.

### Objectives

Healthy lifestyles and livable communities are key considerations in the planning process. Walkability and bikeability play a role in how trails are planned and constructed. Creating diverse opportunities for more people and connecting trails to people is critical in helping to turn around the trend of declining number of kids, and adults who participate in outdoor recreation and help mitigate obesity and other health issues.

All State Park trail plans, including Brandywine Creek State Park, have objectives that recommend:

- Changes to the trail system that meet socially, environmentally and culturally sustainable principles;
- Reducing [habitat fragmentation](#);
- Enhancing habitat quality through sustainable trail planning and design;
- Supporting environmental education opportunities;
- Supporting pedestrian, biking, and equestrian activities;
- Providing a diversity of accessible experiences;
- Considering existing and future recreational trends;
- Integrating the park's trail system as part of wider regional network of existing and future trail opportunities and makes community connections;
- Adapting to future land conservation measures;
- Reducing costly unsustainable trail maintenance achieved by holistic and sound trail planning, construction and innovative trail maintenance techniques;
- Utilizing the best scientific data and research available such as state-wide GIS data layers, user surveys (SCORP), and trail research (such as best practices, erosion, and recreational impacts);
- Enhancements including trail realignments and closures, bridges, trail uses and trail enhancements within accepted sustainable trail standards;
- Include a diverse recreational appeal;
- Has a visual environmental quality;

- Including opportunities to enjoy a great diversity of physical settings;
- Providing visitors with a dynamic mix of interesting experiences that range from easy to challenging;
- A trail system that is safe;
- Considering the existing high school cross country running program;
- Providing water trail access;
- Providing safe trail links between the east and west side of the Brandywine Creek and;
- Providing technical trail challenge.

### Technical Trail Challenge

National and state recreational use trends indicate adventure sports, including triathlon, adventure racing, backpacking, mountain biking, and climbing (to name a few), showing significant growth in the past several years (*Adventure Racing up 28% Outdoor Foundation Topline Reports*). A reoccurring and increasing trend is the interest of users from all trail related activities seeking a challenge. There are various ways to incorporate “challenge” into a trail experience. Integrating tread obstacles and/or maintaining narrow widths are two options for increasing the technical nature of a trail. Creating more technical optional lines along a trail corridor, utilizing man-made or natural features such as logs or rocks, can provide additional interest and challenge to an otherwise easy trail.



*Technical optional lines alongside accessible trail in Redd Park*

## Planned Trail System

The DNREC Trail and Stakeholders Working Group considered the following variables and conditions in making recommendations for new trail alignments: current trail alignments; trail safety; community connections; soil types; topography; hydrology; plant and animal distribution; current and future use; challenge; accessibility; experience; trail use trends; anticipated regional land use growth; park staffing levels; maintenance practices; and trail sustainability.

Final trail alignment decisions were based on reviewing a number of alignment alternatives. [Map 9](#) depicts 18.2 mile planned trail system for Brandywine Creek State Park. [Maps 9 - 16](#) address planned trail [system](#), [sustainability](#), [use](#), [widths](#), [surfaces](#), [accessibility](#), [infrastructure](#), and [naming](#) (see [Appendix A](#)).

Final trail alignment recommendations account for natural resource protection, erosion, hydric soil avoidance, and expansion of trail recreational opportunities. Alignment changes will account for an increase of 1.6 miles of trail, the overall changes will improve sustainability, accessibility, and experience of the trail system.

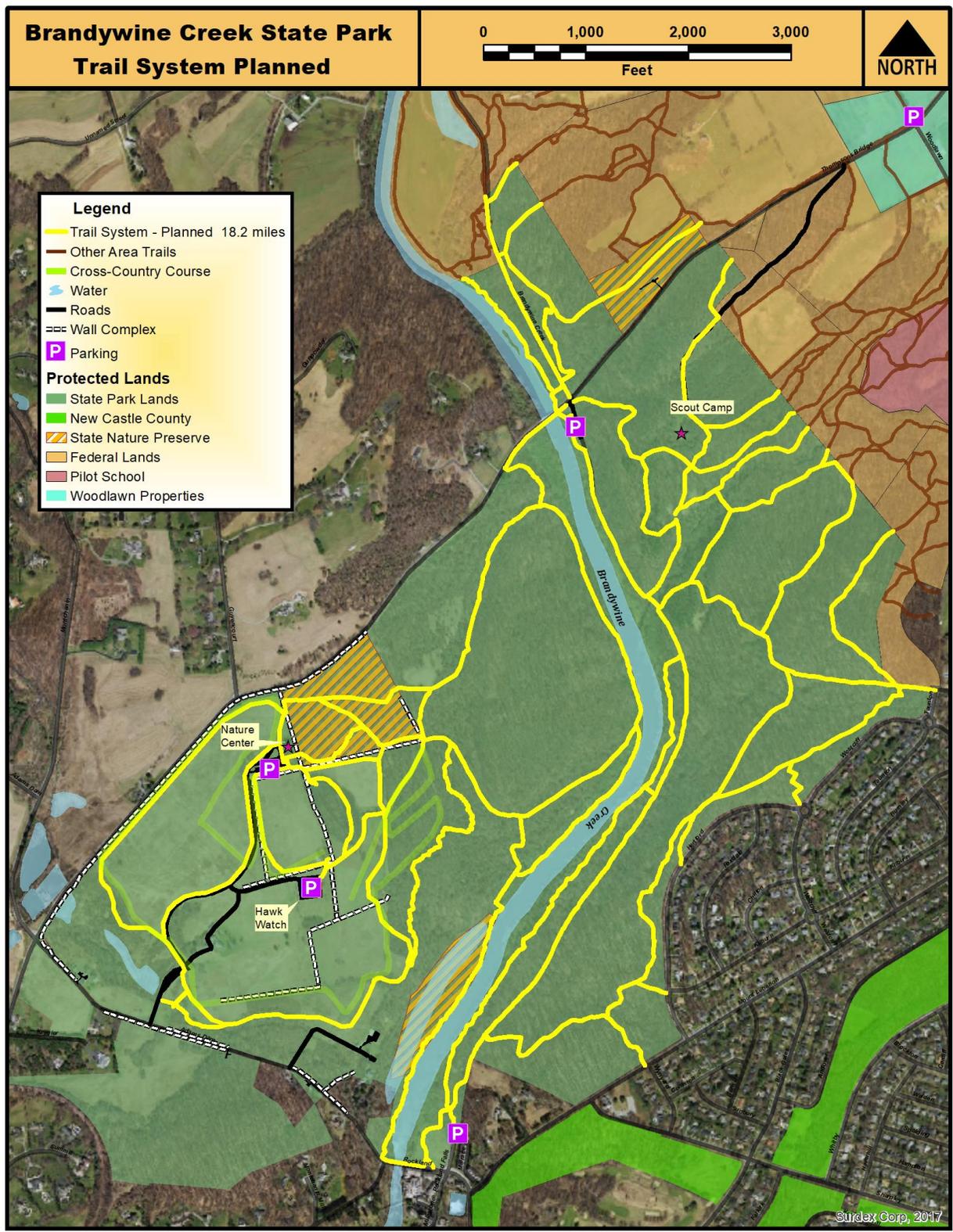


*Creekside Trail*

*Brandywine Trail*



Map 9 - Planned Trail System



Summary: Overall the existing 16.6 mile trail system will be increase by 10% or 1.6 miles.

## Trail Characteristics, Accessibility, Safety, and Infrastructure

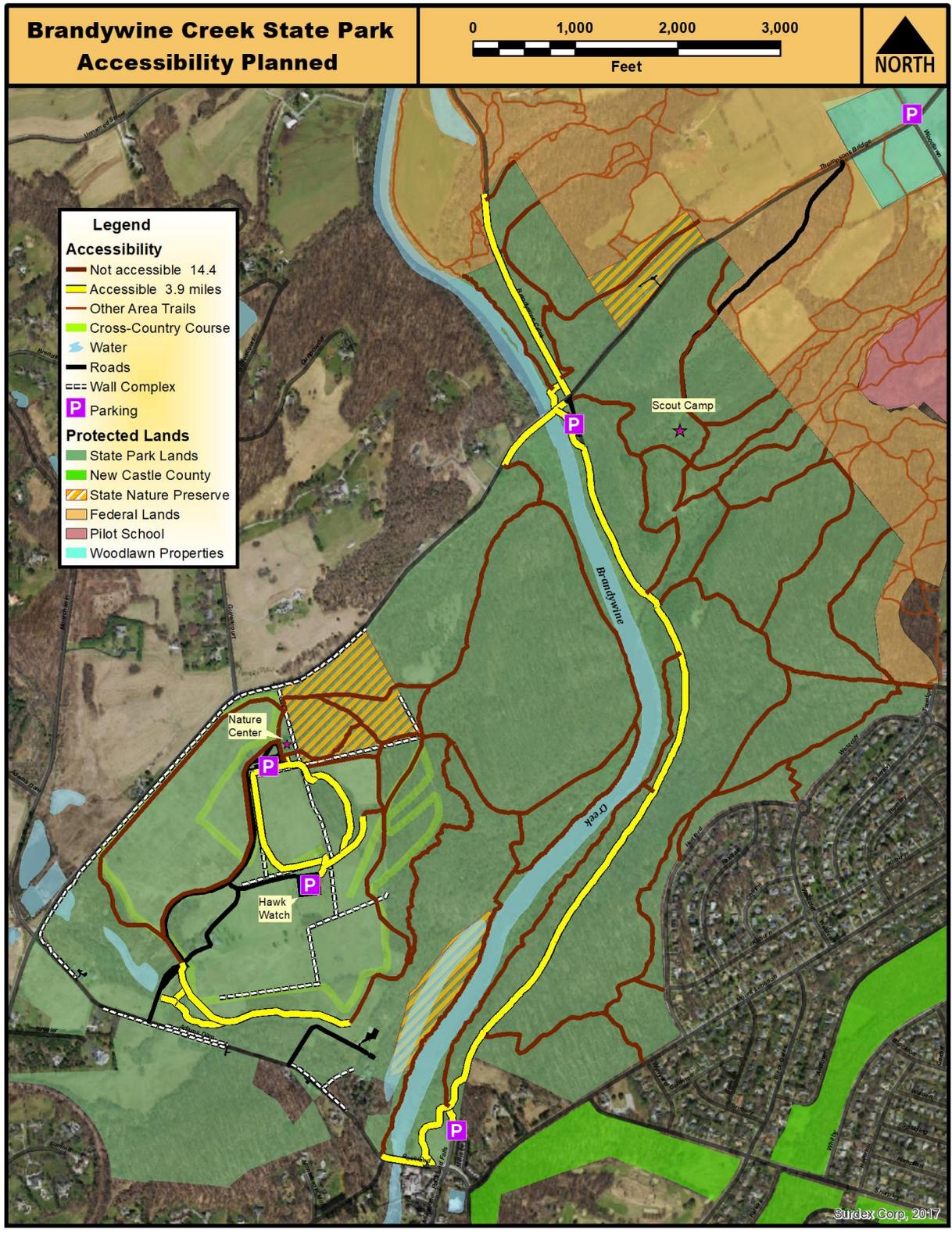
### Trail Characteristics

This plan includes opportunities for improving access for all visitors including those with disabilities. In 2018 Brandywine Creek offered few accessible trail opportunities. Delaware State Parks is committed to providing accessible trails throughout the statewide trail network. [Table 5](#) provides a summary of 2018 trail characteristics and the planned changes (see [Map 15](#) for planned accessible trails). Characteristics covered are surface, width, use, accessibility, and sustainability.

**Table 5** –Current and Planned Trail Characteristics

Trail Characteristics	2018 Trail System	Planned System	Change in Mileage	Percent Change
Total Mileage	16.6	18.2	Increased 1.6	10%
Surface				
Natural	13.3	14.3	Increased 1.0	+8%
Hardened	3.3	3.9	Increased 0.6	+18%
Width				
Single Track	9.2	8.7	Reduced 0.3	-3%
Double Track	7.4	9.5	Increased 2.1	+28%
Permitted Use				
Pedestrian Only	12.6	1.2	Reduced 11.4	-90%
Pedestrian/ Bike	1.3	7.4	Increased 6.1	+470%
Pedestrian/ Equestrian	0.5	0	Reduced 0.5	-100%
Pedestrian/ Bike/Equestrian	2.2	9.6	Increased 7.4	+337%
Accessibility				
Accessible	1.6	3.8	Increased 2.2	+138%
Not Accessible	15.0	14.4	Reduced 0.6	-4%
Sustainability				
Good	8.2	14.8	Increased 6.6	80%
Fair	1.3	2.2	Increased 0.9	69%
Poor	7.1	1.2	Reduced 5.9	83%

[Map 15](#) - Planned Trail Accessibility – shows the planned hardened surface portion of the trail system that will meet or exceed Federal trail accessibility guidelines.



### Trail Safety

Providing the safest user experience possible is linked to good trail planning and construction, performing needed maintenance, and providing the right information for the users. Safety can be broken into two perspectives – user and agency. From the trail user perspective, where to park, what activities are allowed, how to navigate, what type of users one can expect, how wide, long, and steep is the trail, trail etiquette, and how to seek help are some items that must be addressed to keep trails safe. Not everyone will feel the same level of safety for all the different trail experience such as narrow vs. wide trail, single use vs. shared use, or smooth vs. rough tread surface. Providing the right information for the users is critical in allowing the users to make informed decisions on what experiences are right for them. Trail access and wayfinding information is a critical component to trail safety. From a managing agency perspective, good planning, construction, and maintenance is required. An understanding of the landscape design challenges, breadth of trail experiences being offered, types of users, volume of users, maintenance needs, and required signage and information to best guide the trail visitors are all key components to safe trail experiences.

### Trail Infrastructure

Trail infrastructure includes trail wayfinding markers, information boards, and bridges. [Table 7](#) shows bridge infrastructure – existing, new, replacements, and removals ([see Table 7 notes](#)). This trail plan provides general trail wayfinding guidelines. A sign plan will include roadside directions to trailheads or major trail access points throughout the park; trailhead information such as mapping and trail characteristics; and clear trail markings throughout the system that will provide clear direction and safely guide visitors through the trail system back to their point of origin or to their intended destination. An additional layer of wayfinding is a numbering system for marker posts and bridges and graphically representing that numbering system on the park maps.

Park user navigation aids are in the top five of the most used and sought after trail amenity – such as trail maps and markers. Information Centers will be located at all trailhead parking areas ([see Map 14](#)) and will include maps, trail use designations, etiquette, and accessibility information.

State Park trailhead maps exhibit all the official trails – trails constructed and maintained by Delaware State Parks. Maps include trail names, permitted uses, as well as trail width, length and average grade, markers, and bridges. Trail line colors coincide with trail markers colors. For example, the Brandywine Trail is depicted by a red line on the Park map and with red way finding markers on posts along the trail. Marker posts are located at all trail and road intersections and include trail name (color coded to match map), permitted trail uses, and post number. Posts also contain destination/facility information with directional arrows.



*Typical Marker Post*



*Typical Information Board*

## Plan Implementation

Trail construction in Brandywine Creek State Park will occur in phases over time. Environmental and cultural resource review, statewide park project priorities and availability of funding are criteria that determine when projects can be implemented. System wide trail projects fall into two main categories - projects handled by park staff and volunteers or large contract projects requiring engineering and construction companies. Prioritizing potential projects will be guided by public demand, implementation strategies from year to year, and [trail plan objectives](#). Objectives include: accessibility, community linkage, improve sustainability, alternative pedestrian biking transportation corridor, potential or existing level of use, shared use, available funding, available work force, engineering completed, targets key activity, and links other key areas of the park, trails, or other regional trail systems. See [Table 6](#) for system changes.

[Table 6](#) - Planned Trail Changes – the following Table summarizes planned trail changes for widths, current and recommended users, and suitable use for the trail system.

Trail	Trail Type	Width Avg.	Current Trail Users	Future Users	Change Required
Brandywine	Double Track	10 feet	Pedestrian Equestrian Bicycles	Pedestrian Equestrian Bicycles	<ul style="list-style-type: none"> <li>• Paving</li> <li>• Signs</li> </ul>
Creekside	Single Track	3 feet	Pedestrian	Pedestrian Equestrian Bicycles	<ul style="list-style-type: none"> <li>• Signs</li> </ul>
Carney	Single Track	3 feet	Pedestrian	Pedestrian Equestrian Bicycles	<ul style="list-style-type: none"> <li>• Reroutes</li> <li>• Name</li> <li>• Signs</li> </ul>
Fresh Water Marsh	Single Track	3 feet	Pedestrian	Pedestrian Bicycles	<ul style="list-style-type: none"> <li>• Minor Upgrades</li> <li>• Name</li> <li>• Signs</li> </ul>
Hidden Pond	Double Track	5 feet	Pedestrian	Pedestrian Bicycles	<ul style="list-style-type: none"> <li>• Minor Upgrades</li> <li>• Signs</li> </ul>
Longwall	Single Track	3 feet	Pedestrian Bicycles	Pedestrian Equestrian Bicycles	<ul style="list-style-type: none"> <li>• Minor Reroutes</li> <li>• Signs</li> </ul>
Rocky Run	Single Track	3 feet	Pedestrian Equestrian Bicycles	Pedestrian Equestrian Bicycles	<ul style="list-style-type: none"> <li>• Reroutes</li> <li>• Armoring</li> <li>• Signs</li> </ul>
Tulip Tree Woods	Double Track	5 feet	Pedestrian	Pedestrian	<ul style="list-style-type: none"> <li>• New Name</li> <li>• Signs</li> </ul>
Meadow Walk	Double Track	6 feet	NA	<i>Pedestrian Bicycles</i>	<ul style="list-style-type: none"> <li>• <i>New Trail</i></li> <li>• <i>Signs</i></li> </ul>
Wheelwright (Accessible)	Double Track	6 feet	NA	<i>Pedestrian</i>	<ul style="list-style-type: none"> <li>• <i>New Trail</i></li> <li>• <i>Signs</i></li> </ul>
Thompson's Ridge	Single Track	3 feet	NA	<i>Pedestrian Equestrian Bicycles</i>	<ul style="list-style-type: none"> <li>• <i>New Trail</i></li> <li>• <i>Signs</i></li> </ul>
Wilson Run (Accessible)	Double Track	6 feet	NA	<i>Pedestrian Bicycles</i>	<ul style="list-style-type: none"> <li>• <i>New Trail</i></li> <li>• <i>Signs</i></li> </ul>

 Existing Trail

 *Planned New Trail*

## [Action Items](#)

Protection of existing natural and cultural resources and providing recreational opportunities in state designated resource areas is of primary concern. Recreation at Brandywine Creek State Park falls into two major categories, active (such as cross country course and disc golf) and passive recreation (trail activities like hiking and biking). Lands that fall within the active areas should continue to take the brunt of recreational impact. Lands that fall within the passive areas should be protected to the fullest with limited additional infrastructure added. In response to an internal assessment of the state of the trails at BCSP a list of action items have been established that will improve upon the existing infrastructure.

Action items that will provide safer, consistent trail access to and within the park:

- Upgrade all trails where needed to meet sustainability goals
- Provide more information to visitors on trail characteristics (width, use, surface, accessibility), and etiquette
- Replace, repair, remove, or install new bridges
- Install new or improve existing trail links to communities
- Create a safe connection along Thompson Bridge between east and west side of park
- Create accessible trail experiences along the Brandywine Creek, Wilson Run, and meadows and forest surrounding and linking to the nature center and Hawk Watch trailhead.

Action items for long term protection:

- Close all trail segments not included in the trail plan
- Monitor degraded areas for natural recovery
- Promote plant re-colonization
- Install barriers where needed
- Analyze access sites as they pertain to hunting in protected resource areas

The following projects listed below of top priorities fall into either the short, mid, or long-term category. Short-term priorities should be accomplished in the first few years after official adoption of the plan. Mid-term priorities should be undertaken within three to five years. Long-term projects are at least five years out.

## [Priority Project List](#)

### Short Term

- Update way-finding system including trail names reconfiguring. See [Map 16](#)
- Rebuild or remove bridges that do not meet safety codes- short term. See [Table 7](#)
- Construct accessible trail from Nature Center to Hawk Watch Trailhead.
- Close down select trails to be removed from the system.
- Update allowable trail use across the system.
- Reconstruct and/or pave Brandywine Trail from Rocky Run south.

### Mid Term

- Reconstruct and pave Brandywine Trail from Thompson Bridge north to NPS line.
- Construct accessible trail along Wilsons Run.
- Improve water access.

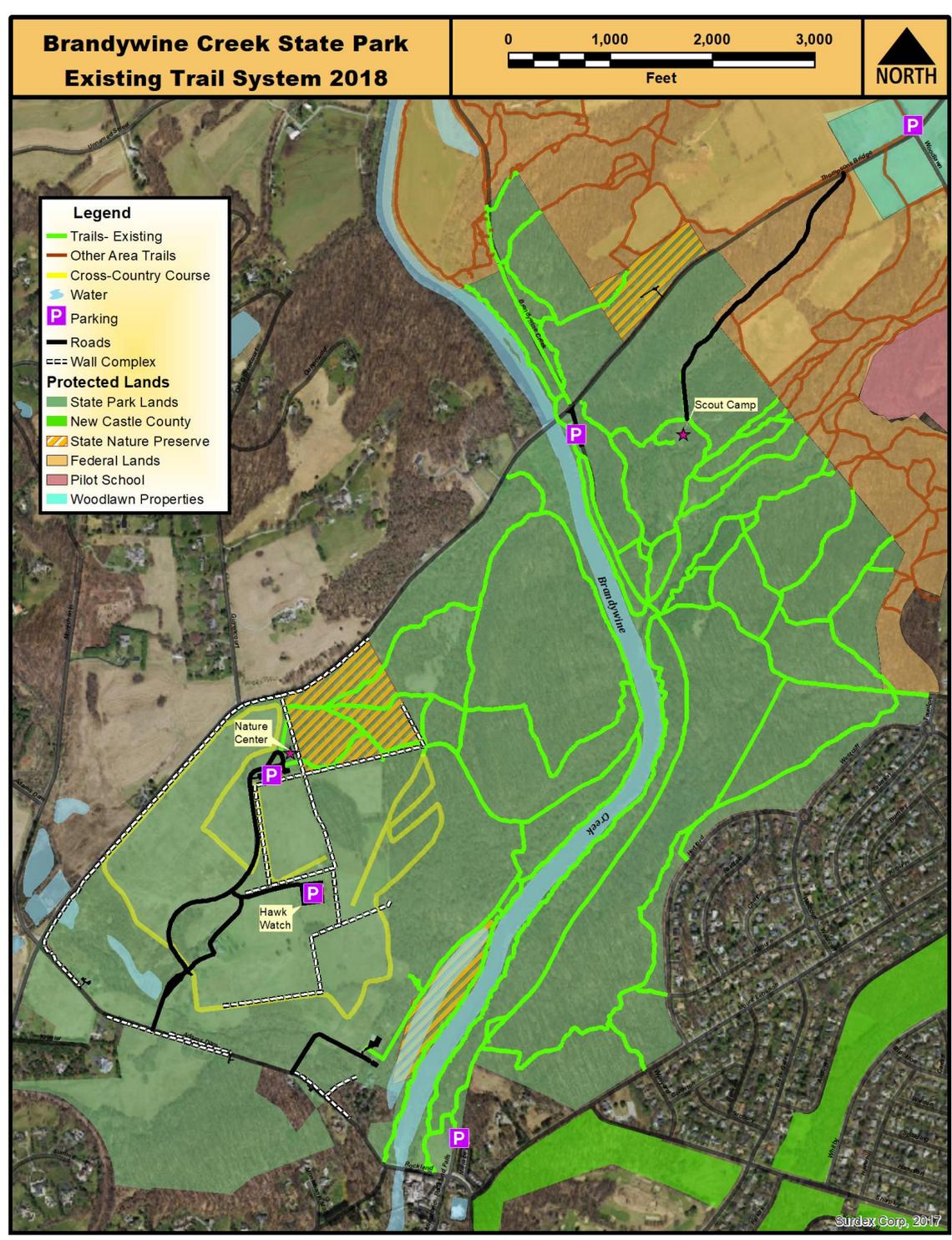
### Long Term

- East to West side connection.

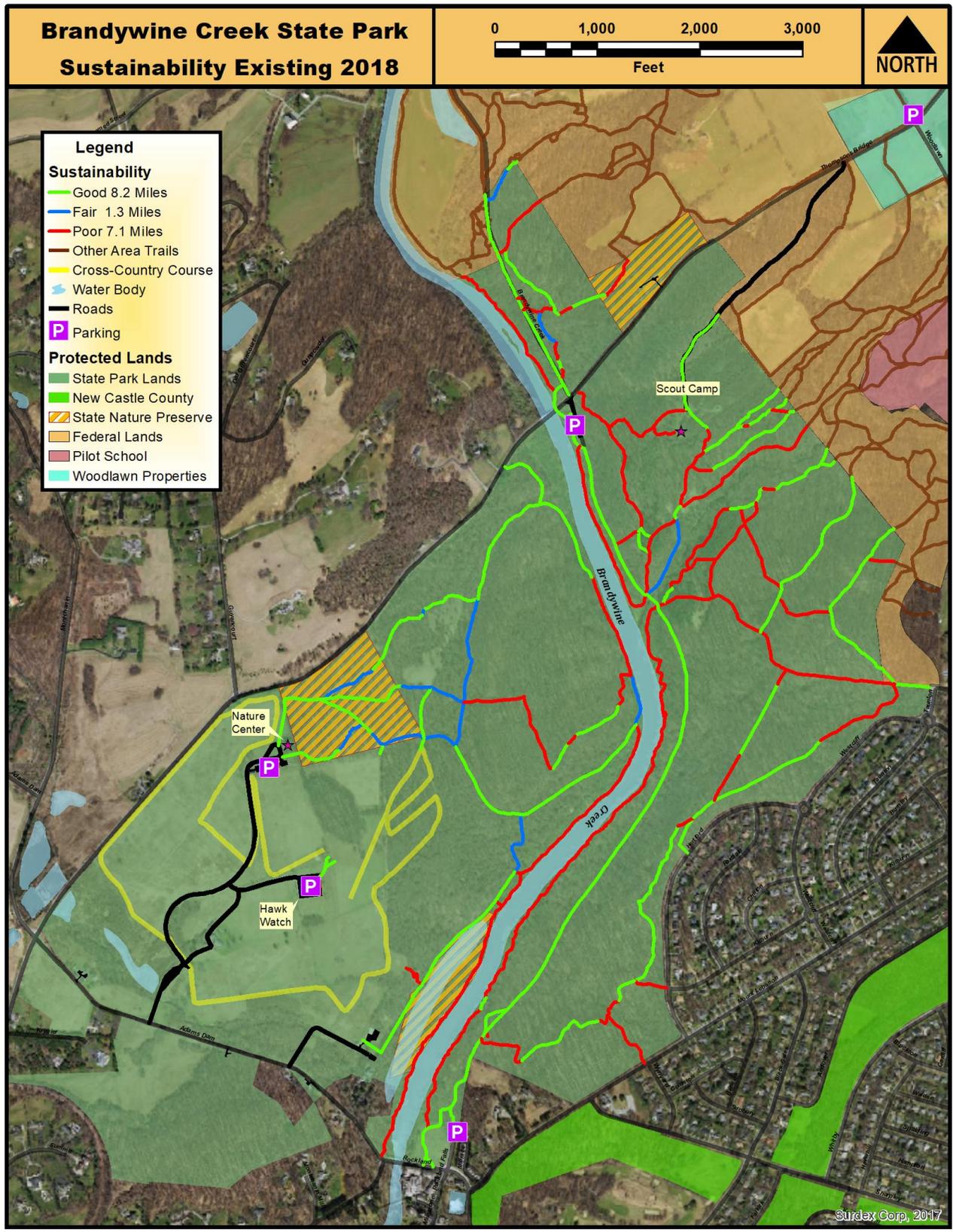
# Appendix

## Appendix A: 2018 Existing and Planned Condition Maps

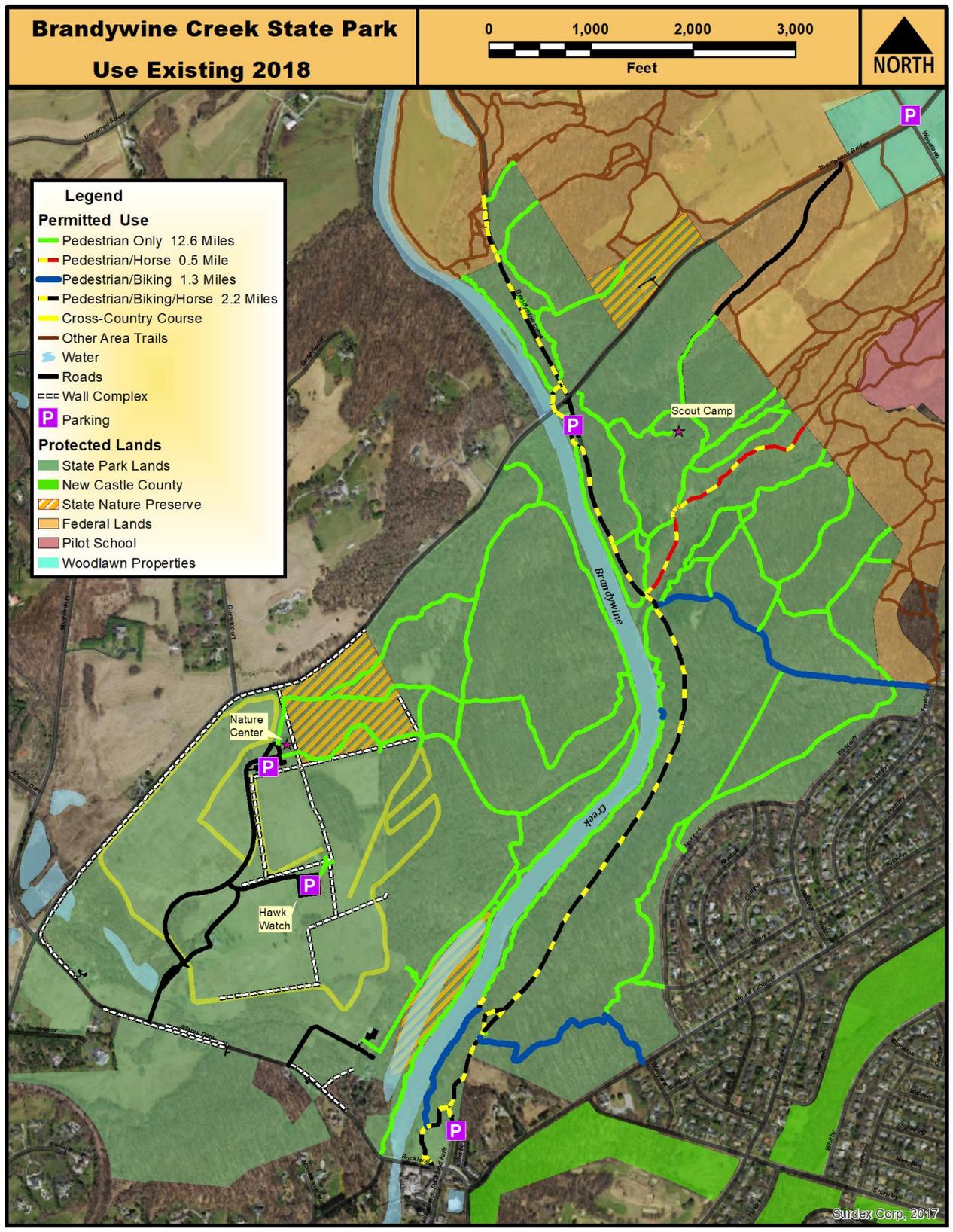
Map 1 - 2018 Trail System



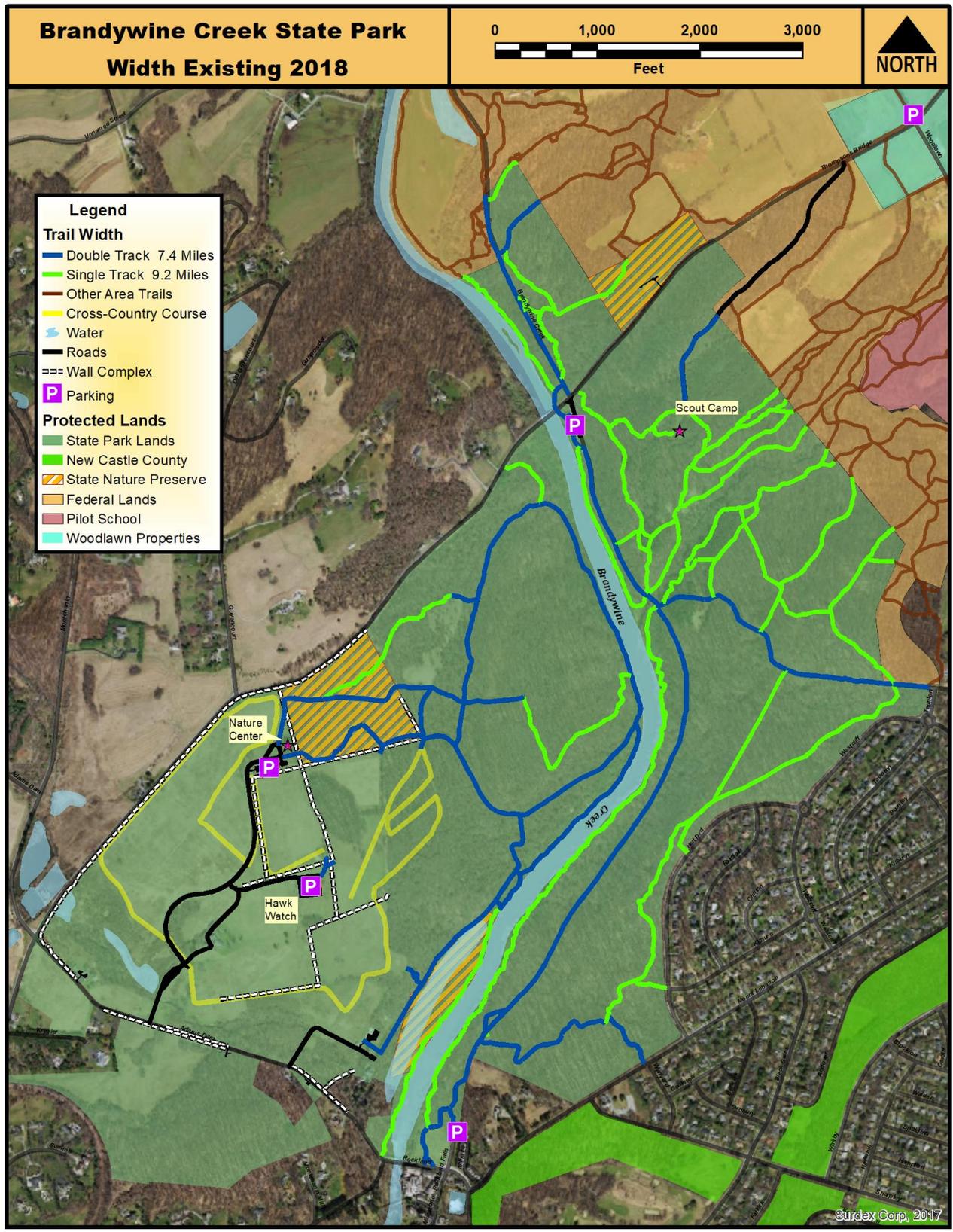
Map 2 – 2018 Sustainability



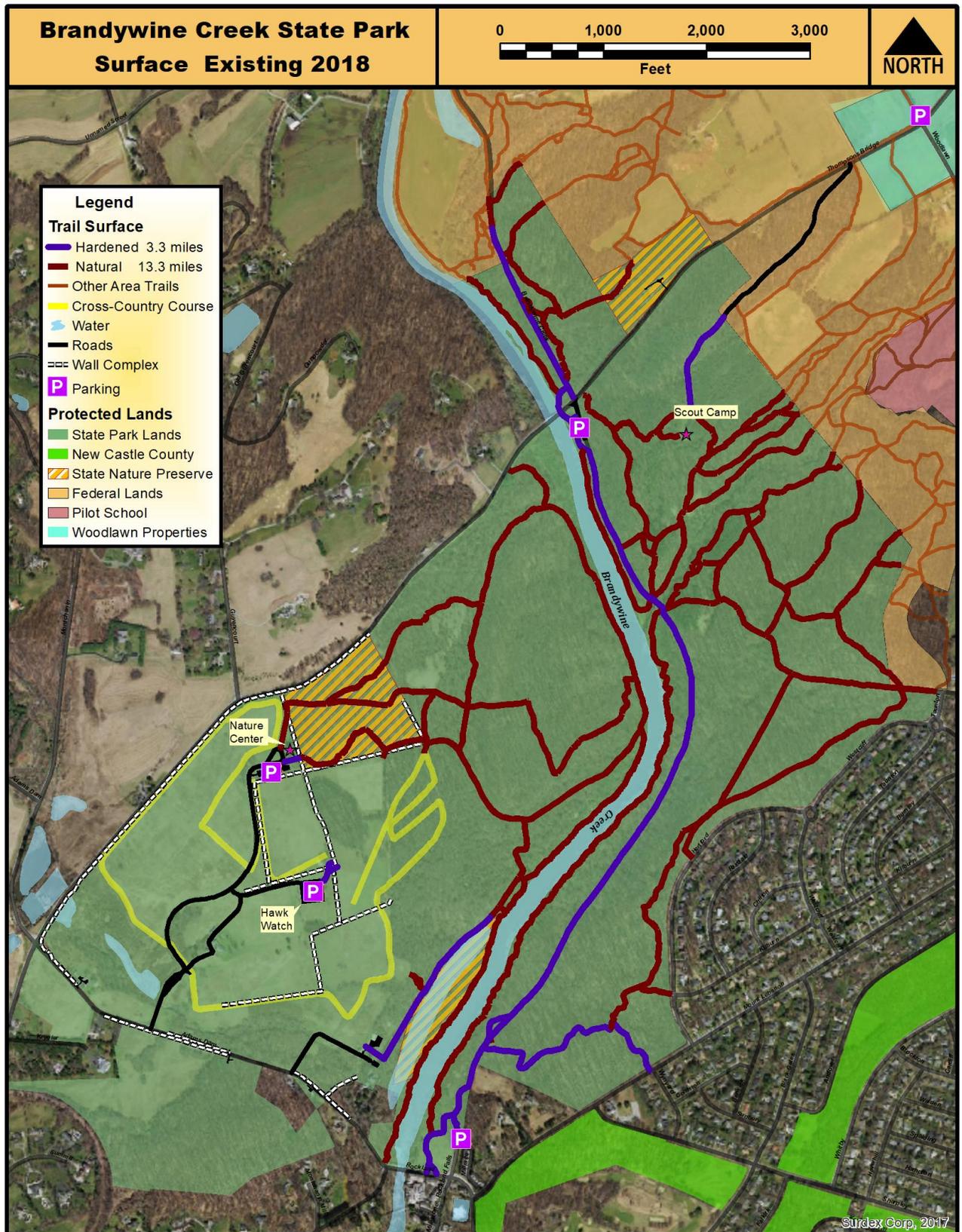
Map 3 - 2018 Permitted Trail Uses



Map 4 - 2018 Trail Width

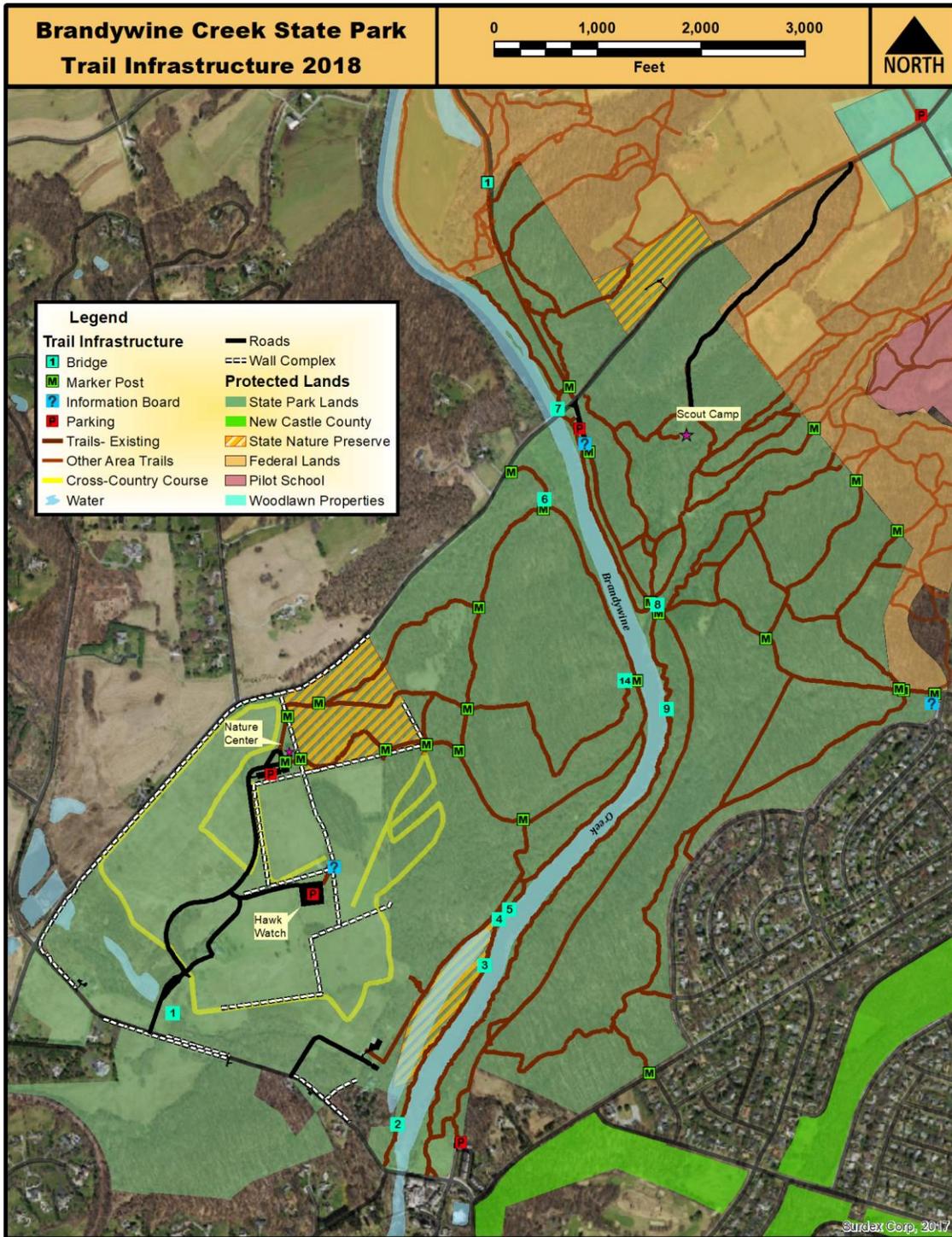


Map 5 - 2018 Trail Surfaces

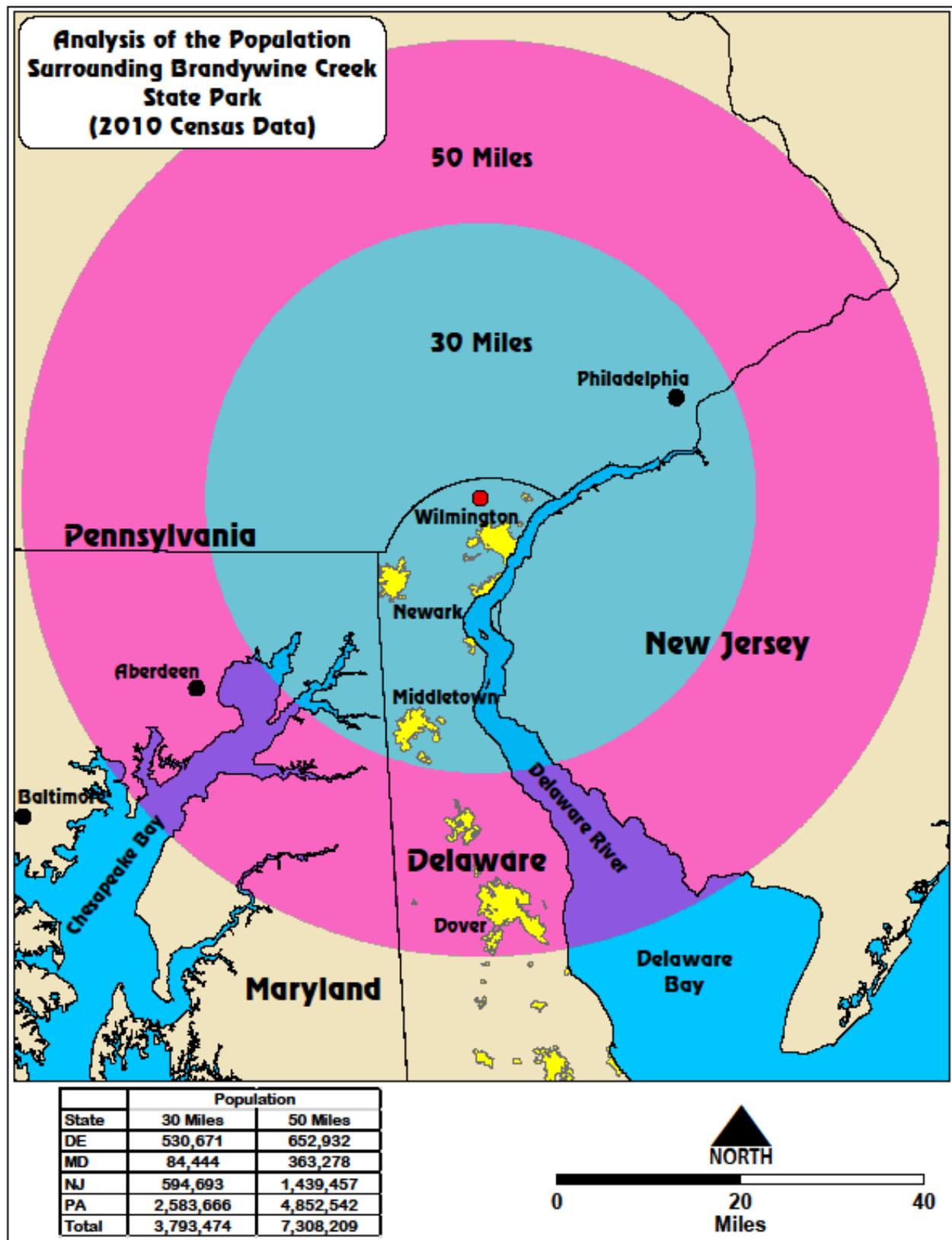


Map 6 shows locations of trailhead parking lots, information boards, bridges, and trail markers within the existing Brandywine Creek State Park trail system. All parking areas for trail access are depicted with the P icon. Access to the trail system is available via four parking lots or trailheads and one location that can accommodate equestrian trailers – the Thompson Bridge area.

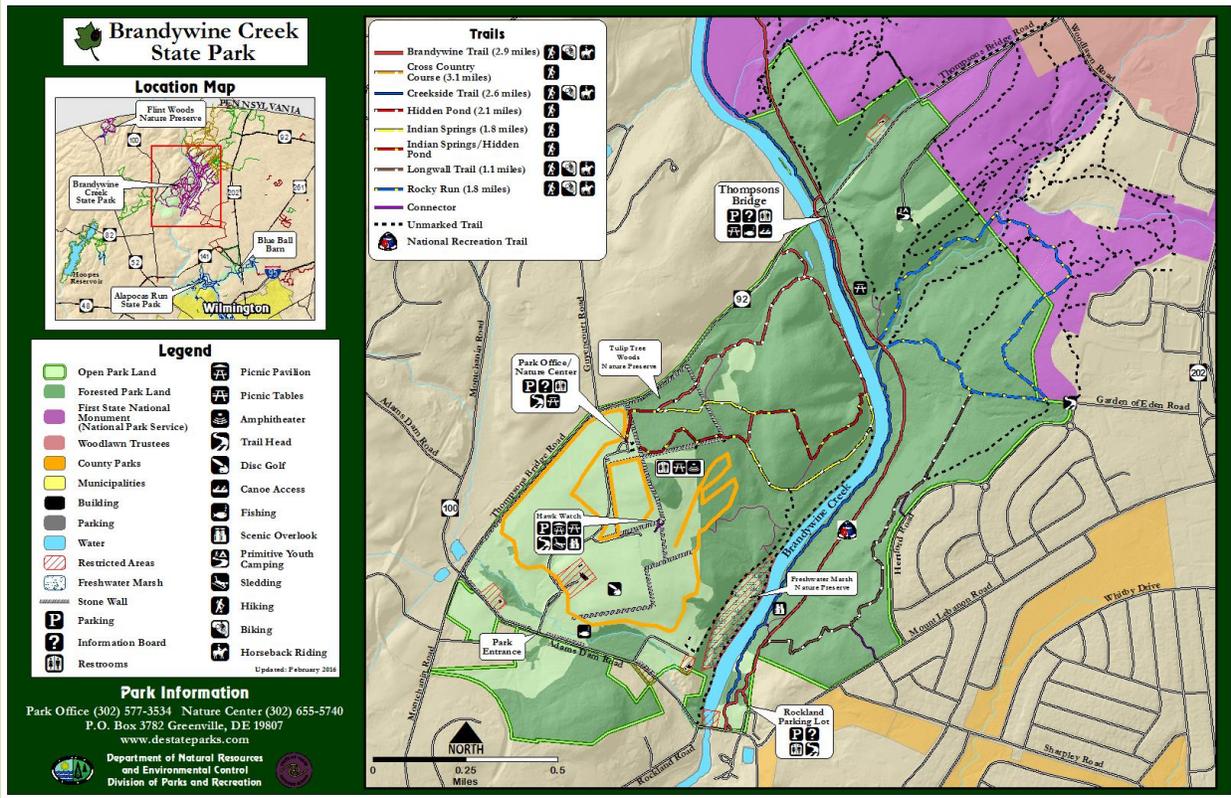
Map 6 - 2018 Trail Infrastructure



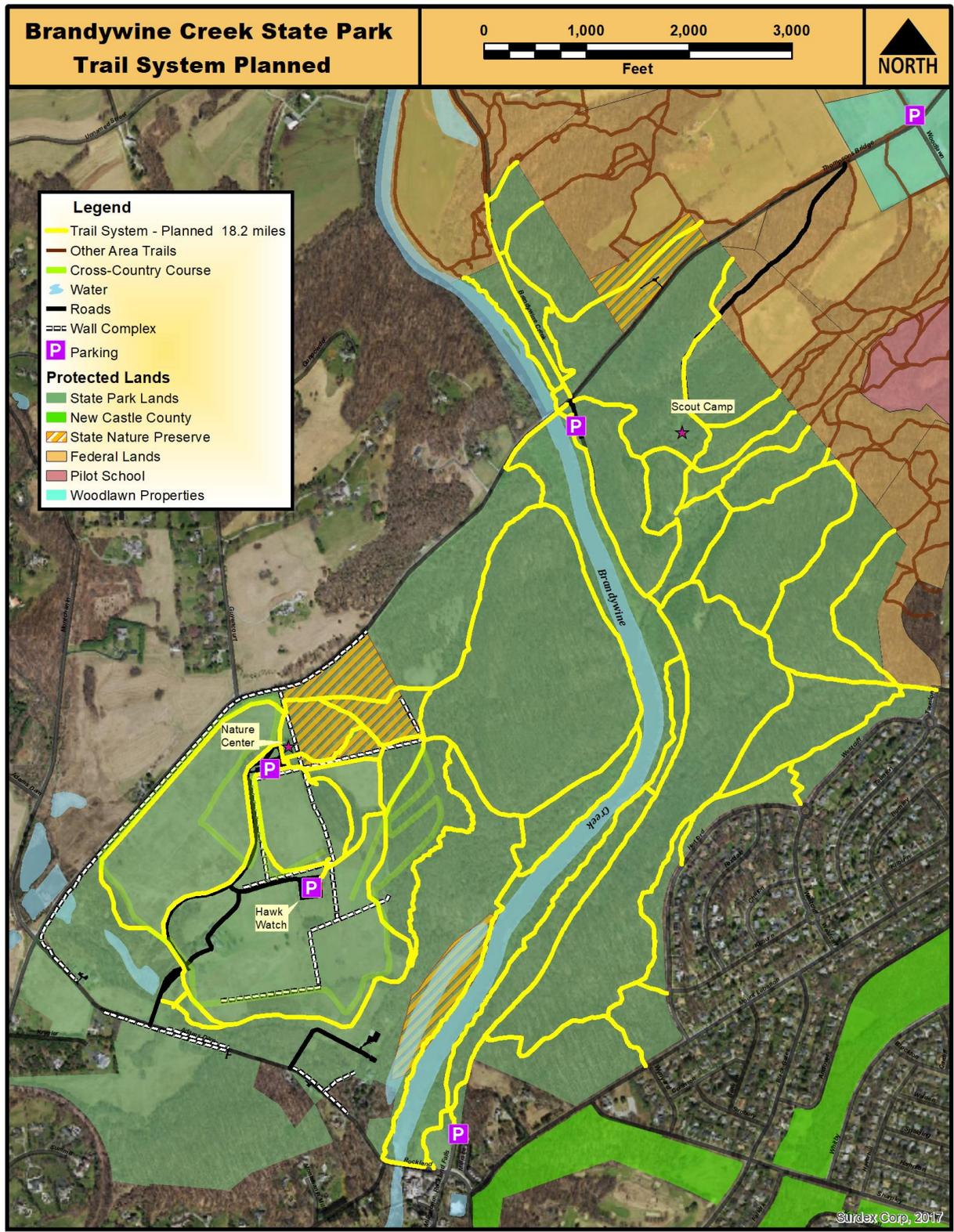
Map 7 – Brandywine Creek State Park Regional Context



Map 8 – Brandywine Creek State Park

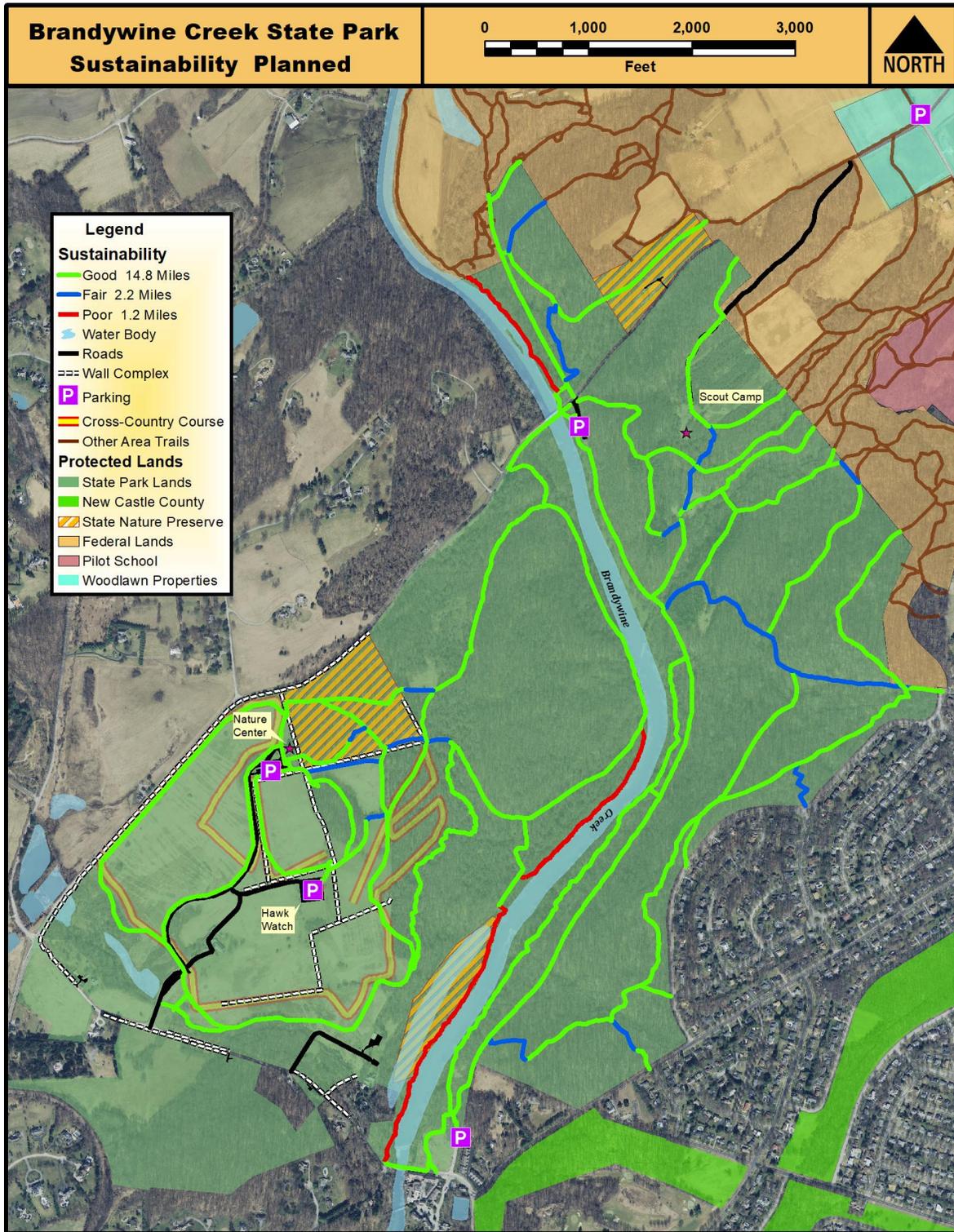


Map 9 - Planned Trail System



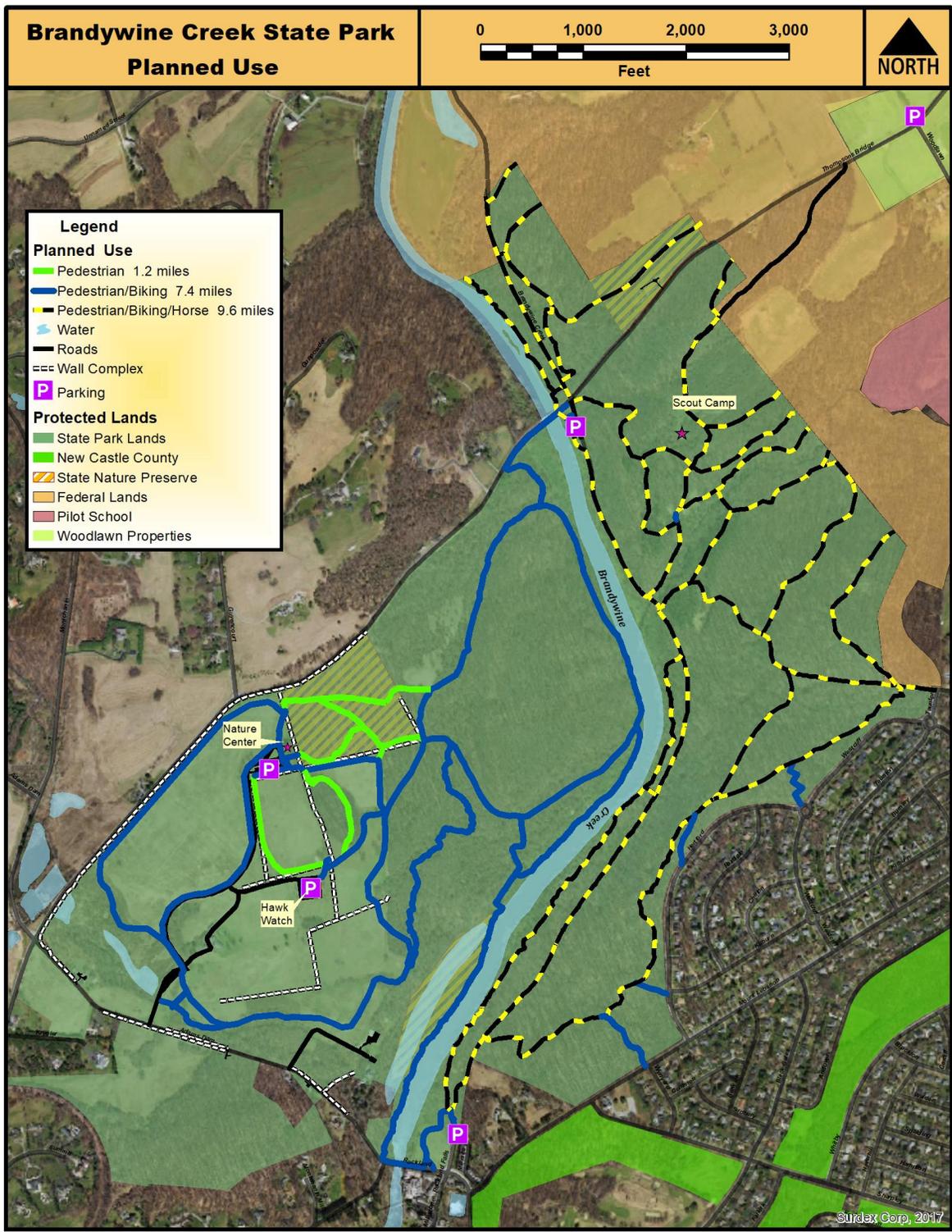
Summary: The current 16.6 mile trail system will be increase by 10% or 1.6 miles to 18.2 miles.

Map 10 - Planned Trail Sustainability



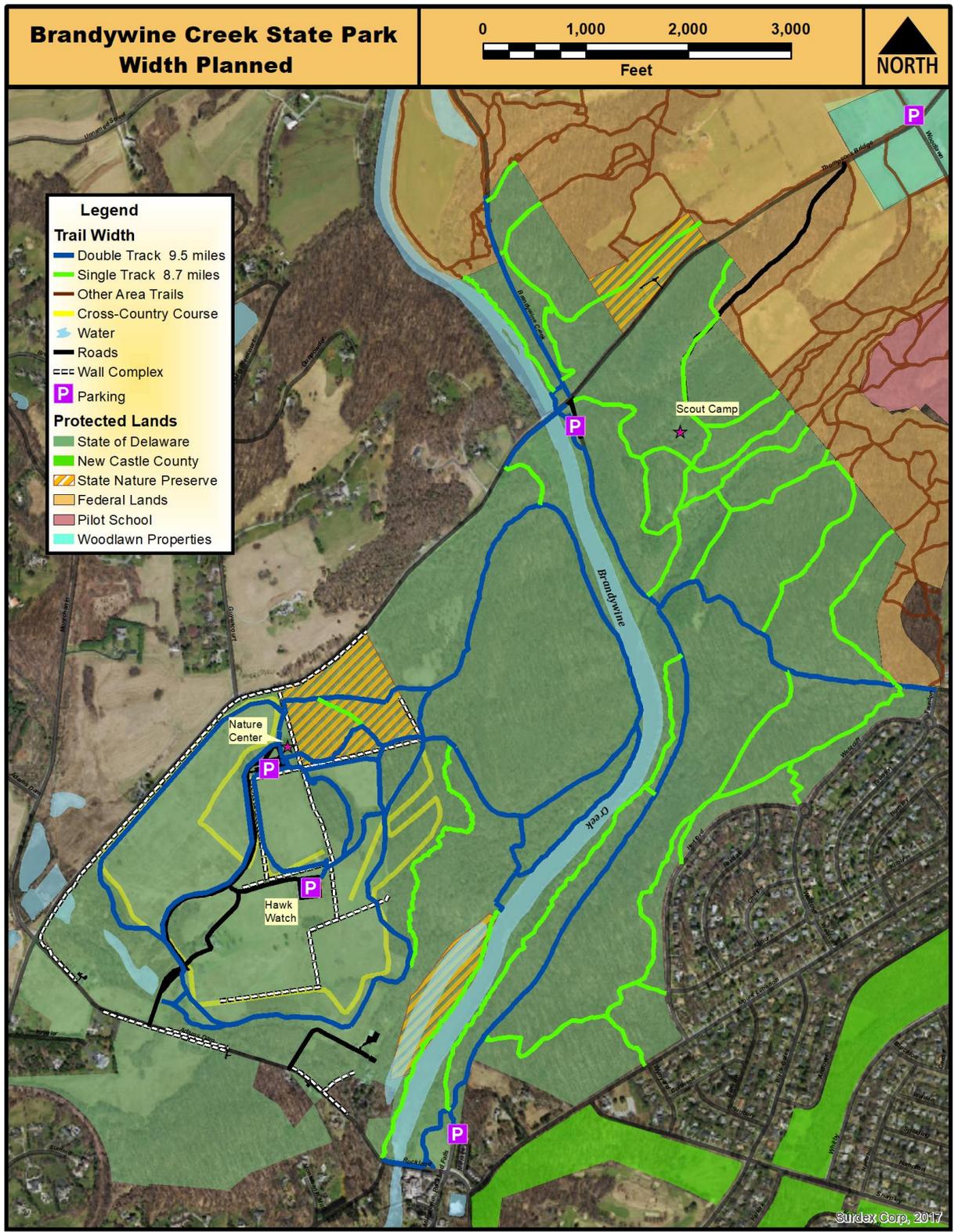
Summary: With realignments and enhancements and new construction techniques, the existing 7.1 miles of poor trail sustainability will be reduced by 83% or 5.9 miles.

Map 11 - Planned Trail Use



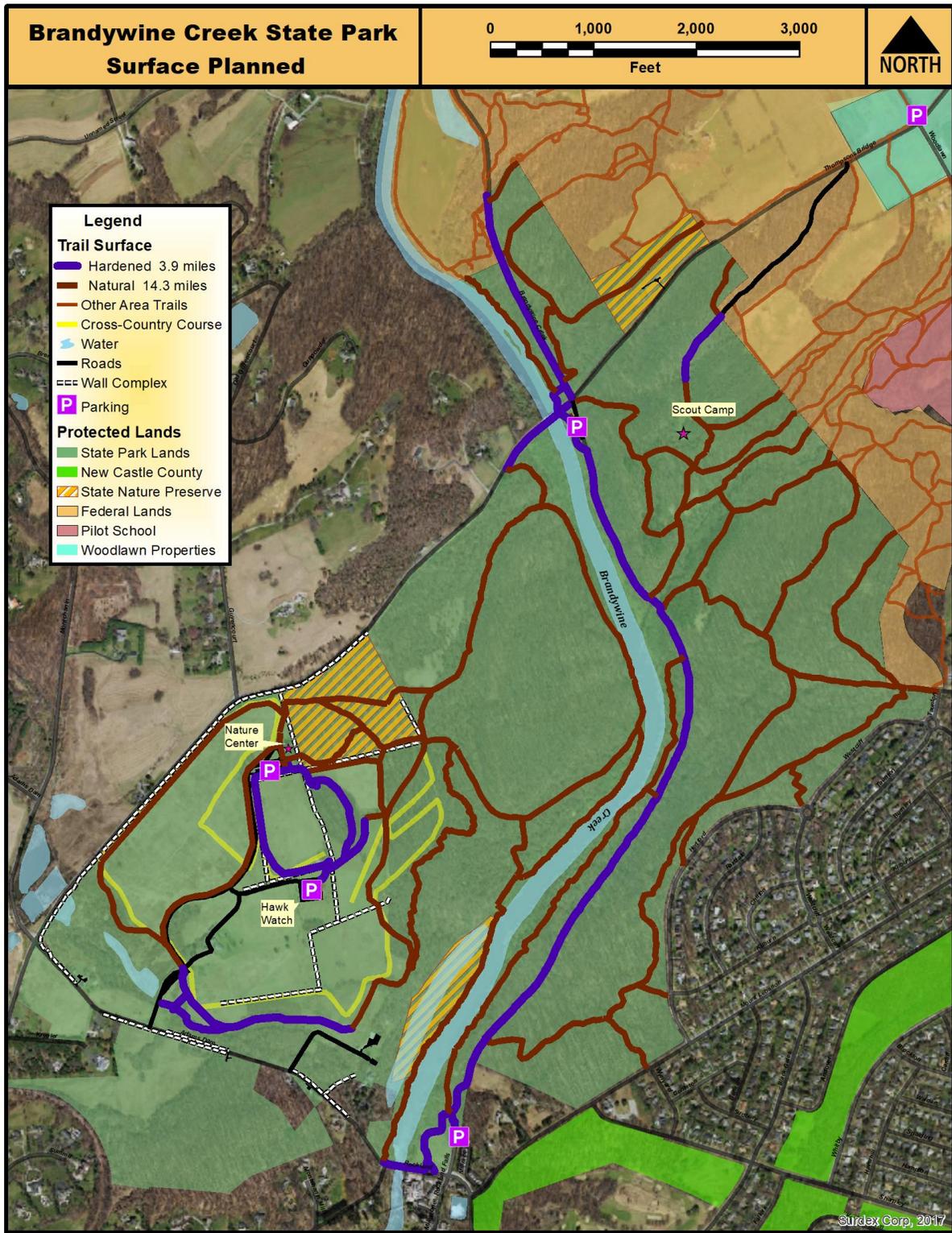
Summary: Current 12.6 miles of pedestrian only trail will decrease by 90% to 1.2 miles; Current 1.3 miles of pedestrian and biking trail will increase by 470% to 7.4 miles; and current 2.2 miles of pedestrian, biking, and equestrian trail will increased by 37% to 9.6 miles.

Map 12- Planned Trail Width



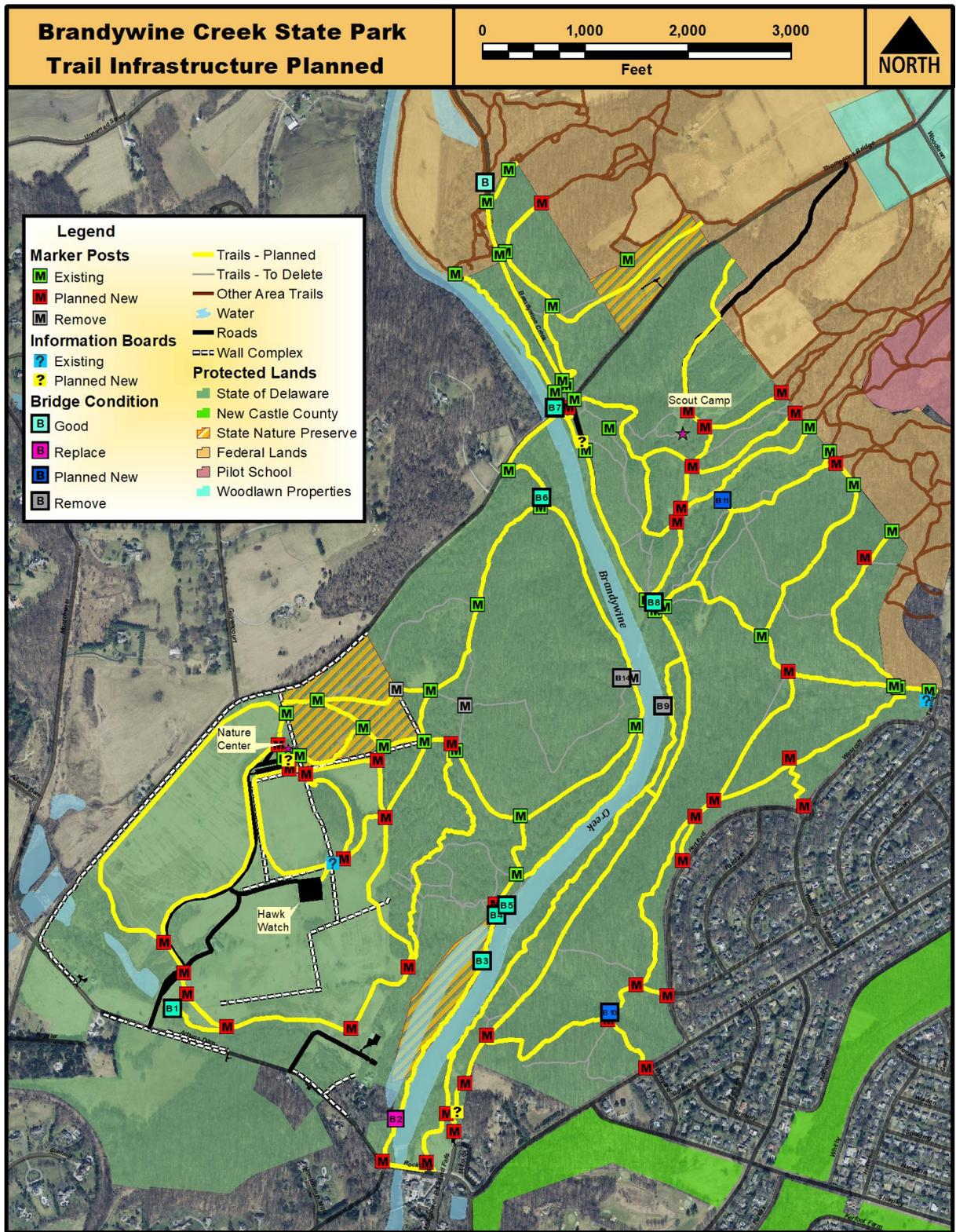
Summary: Current 7.4 miles of double track trail will increase by 28% to 9.5 miles; Current 9.2 miles of single track trail will decrease by 3% to 8.7 miles.

Map 13- Planned Trail Surfaces

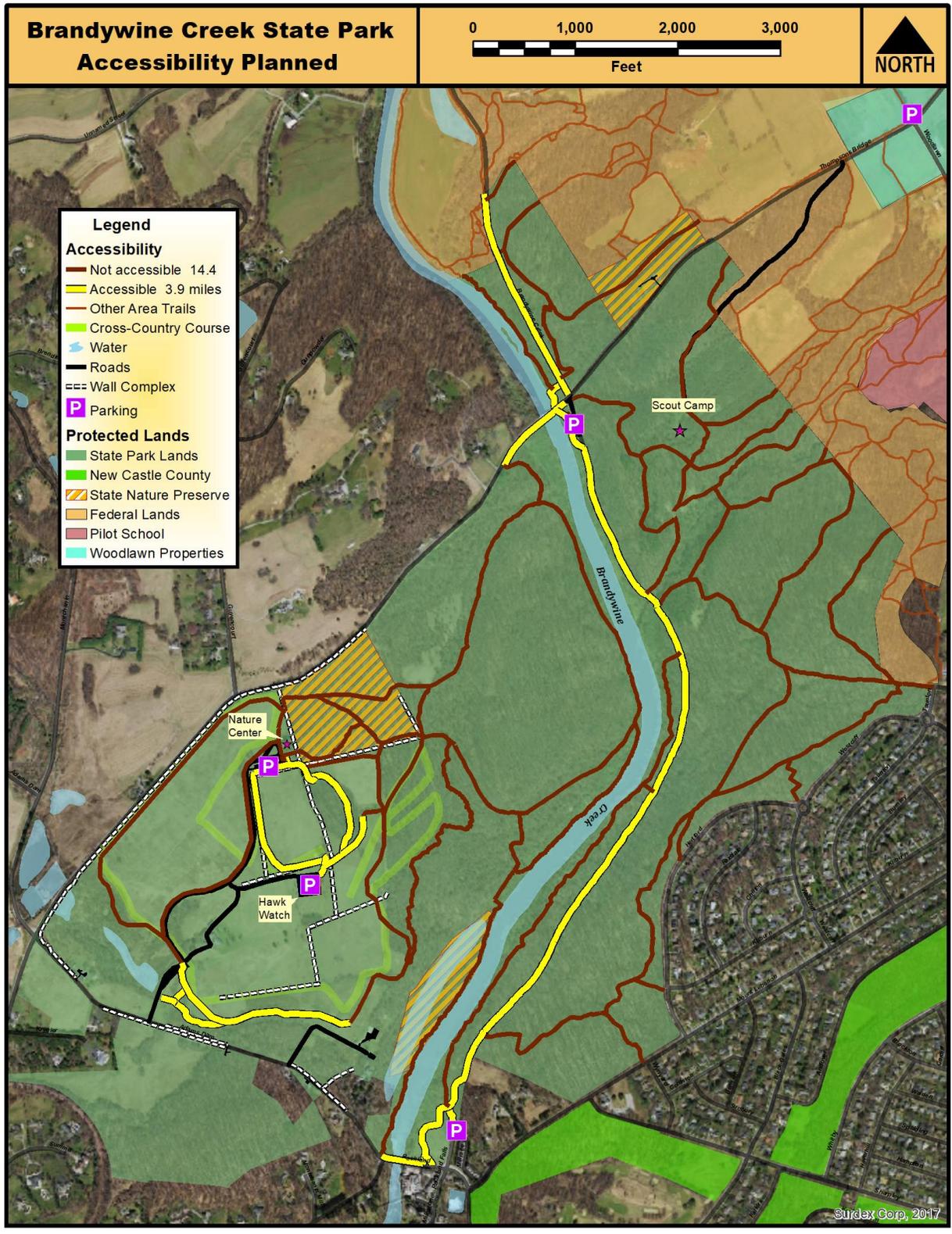


Summary: Current 3.3 miles of hardened surface trail will increase by 18% or 0.6 miles. 13.3 miles of natural surface trail will be increased by 1.0 mile or 8%.

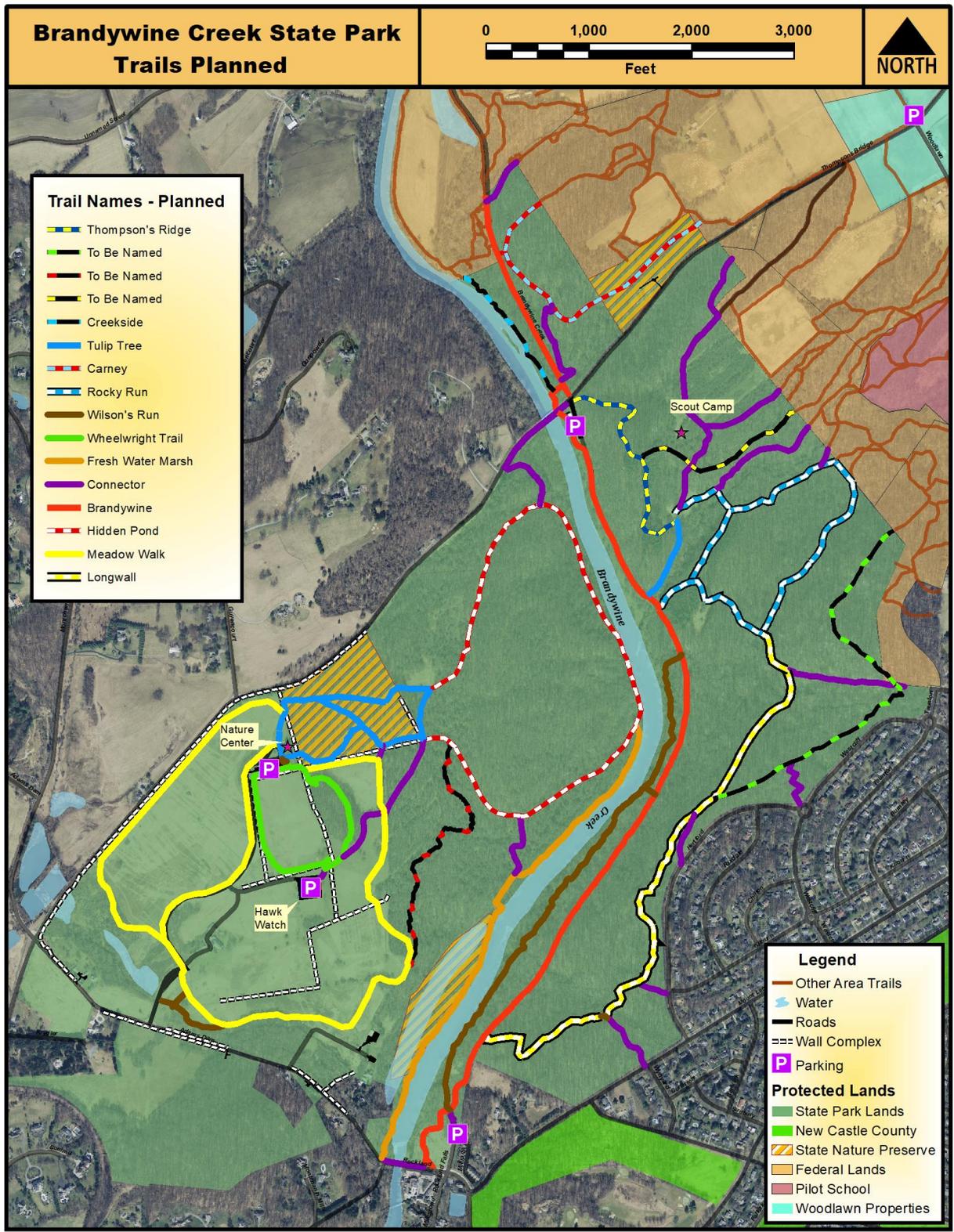
Map 14 - Planned Trail Infrastructure



[Map 15](#) - Planned Trail Accessibility – shows the planned hardened surface portion of the trail system that will meet or exceed Federal trail accessibility guidelines.



Map 16 - Planned Trail Naming Convention and Locations



## Appendix B: Tables

[Table 1](#), Statewide Trail Distribution Analysis, provides an overview of the State Park trail systems.

[Table 1](#) – State Park Trail Distribution Analysis

County	State Park	Miles	Percent of Total Trail Miles	Total Miles	Percent Total Trail Miles Per County	*Percent Total Population
New Castle	Alapocas Run SP	6.5	4%	102	65%	59%
	Auburn Heights NP	3.7	2%			
	Bellevue SP	9.6	6%			
	Brandywine Cr SP	16.6	11%			
	Flint Woods NP	2.4	2%			
	Fort DE SP	0.8	0.5%			
	Fort DuPont SP	1.3	1%			
	Fox Point SP	2.3	1%			
	Lums Pond SP	16.6	11%			
	White Clay Cr SP	38.6	25%			
	Wilmington SP	3.5	3%			
Kent	Killens Pond SP	7	4%	7	4%	18%
Sussex	Barnes Woods NP	0.8	0.5%	47.5	31%	23%
	Cape Henlopen SP	21.5	14%			
	DE Seashore SP	8.5	5%			
	Fenwick Is SP	0	0.0%			
	Holts Landing SP	2.4	2%			
	Trap Pond SP	13.8	9%			
Total		156.5	100%	156.5	100%	100%

County	Trail Usage (miles)		Trail Width (miles)		Trail Surfacing (miles)	
	Shared Use	Single Use (Pedestrian Only)	Double Track	Single Track	Natural Surface Tread	Hardened Surface Tread
New Castle	68	34	59	43	62	40
Kent	3.5	3.5	6	1	3.5	3.5
Sussex	37.5	10	40	7.5	17.5	30
Total	109	47.5	105	51.5	83	73.5

**Table 2 - 2018 Trail Uses**

Trail Uses	Mileage
Total Trails	16.6
Pedestrian	16.6
Pedestrian Only	12.6
Bike	3.5
Equestrian	2.7
Pedestrian/Bike	1.3
Pedestrian/Equestrian	0.5
Pedestrian/Bike/Equestrian	2.3

**Table 3 - 2018 Trail Characteristics**

Trail Characteristics	2018 Trail Mileage	Percentage of Park System
Total Mileage	16.6	100%
Surface		
Natural	13.3	80
Hardened	3.3	20
Width		
Single Track	9.2	55
Double Track	7.4	45
Permitted Use		
Pedestrian Only	12.6	76
Pedestrian/ Bike	1.3	8
Pedestrian/ Equestrian	0.5	2
Pedestrian/ Bike/Equestrian	2.2	12
Accessibility		
Accessible	1.6	3.8
Not Accessible	15.0	14.4

**Table 4-** Existing Trail Miles & Uses

Trail	Length in Miles	Pedestrian	Biking	Equestrian
Brandywine	2.9	√	√	√
Creekside	2.6	√		
Hidden Pond	1.6	√		
Indian Springs	1.8	√		
Longwall	1.1	√	√	
Rocky Run	1.8	√	√	√
Tulip Tree Woods	0.5	√		
Unnamed Trails	5.8	√	√	√

**Table 5** –Current and Planned Trail Characteristics

Trail Characteristics	2018 Trail System	Planned System	Change in Mileage	Percent Change
Total Mileage	16.6	18.2	Increased 1.6	10%
Surface				
Natural	13.3	14.3	Increased 1.0	+8%
Hardened	3.3	3.9	Increased 0.6	+18%
Width				
Single Track	9.2	8.7	Reduced 0.3	-3%
Double Track	7.4	9.5	Increased 2.1	+28%
Permitted Use				
Pedestrian Only	12.6	1.2	Reduced 11.4	-90%
Pedestrian/ Bike	1.3	7.4	Increased 6.1	+470%
Pedestrian/ Equestrian	0.5	0	Reduced 0.5	-100%
Pedestrian/ Bike/Equestrian	2.2	9.6	Increased 7.4	+337%
Accessibility				
Accessible	1.6	3.8	Increased 2.2	+138%
Not Accessible	15.0	14.4	Reduced 0.6	-4%
Sustainability				
Good	8.2	14.8	Increased 6.6	80%
Fair	1.3	2.2	Increased 0.9	69%
Poor	7.1	1.2	Reduced 5.9	83%

**Table 6 - Planned Trail Changes** – the following Table summarizes planned trail changes for widths, current and recommended users, and suitable use for the trail system.

Trail	Trail Type	Width Avg.	Current Trail Users	Future Users	Change Required
Brandywine	Double Track	10 feet	Pedestrian Equestrian Bicycles	Pedestrian Equestrian Bicycles	<ul style="list-style-type: none"> <li>• Paving</li> <li>• Signs</li> </ul>
Creekside	Single Track	3 feet	Pedestrian	Pedestrian Equestrian Bicycles	<ul style="list-style-type: none"> <li>• Signs</li> </ul>
Carney	Single Track	3 feet	Pedestrian	Pedestrian Equestrian Bicycles	<ul style="list-style-type: none"> <li>• Reroutes</li> <li>• Name</li> <li>• Signs</li> </ul>
Fresh Water Marsh	Single Track	3 feet	Pedestrian	Pedestrian Bicycles	<ul style="list-style-type: none"> <li>• Minor Upgrades</li> <li>• Name</li> <li>• Signs</li> </ul>
Hidden Pond	Double Track	5 feet	Pedestrian	Pedestrian Bicycles	<ul style="list-style-type: none"> <li>• Minor Upgrades</li> <li>• Signs</li> </ul>
Longwall	Single Track	3 feet	Pedestrian Bicycles	Pedestrian Equestrian Bicycles	<ul style="list-style-type: none"> <li>• Minor Reroutes</li> <li>• Signs</li> </ul>
Rocky Run	Single Track	3 feet	Pedestrian Equestrian Bicycles	Pedestrian Equestrian Bicycles	<ul style="list-style-type: none"> <li>• Reroutes</li> <li>• Armoring</li> <li>• Signs</li> </ul>
Tulip Tree Woods	Double Track	5 feet	Pedestrian	Pedestrian	<ul style="list-style-type: none"> <li>• New Name</li> <li>• Signs</li> </ul>
Meadow Walk	Double Track	6 feet	NA	<i>Pedestrian Bicycles</i>	<ul style="list-style-type: none"> <li>• <i>New Trail</i></li> <li>• <i>Signs</i></li> </ul>
Wheelwright (Accessible)	Double Track	6 feet	NA	<i>Pedestrian</i>	<ul style="list-style-type: none"> <li>• <i>New Trail</i></li> <li>• <i>Signs</i></li> </ul>
Thompson's Ridge	Single Track	3 feet	NA	<i>Pedestrian Equestrian Bicycles</i>	<ul style="list-style-type: none"> <li>• <i>New Trail</i></li> <li>• <i>Signs</i></li> </ul>
Wilson Run (Accessible)	Double Track	6 feet	NA	<i>Pedestrian Bicycles</i>	<ul style="list-style-type: none"> <li>• <i>New Trail</i></li> <li>• <i>Signs</i></li> </ul>

 Existing Trail

 Planned New Trail

**Table 7** Trail Bridge Conditions

Trail	Bridge Number	2015 Condition	Planned Action
	1	Good	None
	2	Poor	Replace
	3	Good	None
	4	Good	None
	5	Good	None
	6	Good	None
	7	Good	None
	8	Good	None
	9	Good	Remove <sup>1</sup>
	10	Planned	Construct
	11	Planned	Construct
	14	Poor	Remove <sup>2</sup>

Notes:

1. Remove and replace with rock structure
2. Remove when trail segment gets deleted from system

## Appendix C: Sustainable Trail Best Management Practices

Designing, constructing, and properly maintaining trails for sustainability is of paramount importance to preserving the designed experience, health, and life span of the trail system. Many trail management problems, ranging from erosion to user conflicts, stem from poor trail planning and design, management, and use. A poorly designed trail, no matter how well it is built, will degrade at a faster rate and cause more problems for managers and trail users.

User type and volume impacts are most notable on natural surface trails. Over the years there have been a number of studies that have examined the relationship between users and the trail. The ability to loosen or displace (move short distances) tread materials will help determine the sustainability of any given trail. Although the “footprint” may look different, the foot and the tire exhibit about the same amount of wear and tear on the trail-pounds per square inch on the tread are actually lower for a bike. The equestrian, at least four times the weight, can have a more dramatic effect on compacting or loosening the tread. Once tread materials are loose they become more susceptible to displacement and/or erosion. Depending on soil conditions, user type and volumes, trail width, canopy cover, and slopes, the amount and distance of displacement or erosion will vary. In general the distance for displacement will not exceed one or two feet. Erosion on the other hand is not confined to short distances; in fact soil may be carried hundreds if not thousands of feet by water.

Site conditions all being equal, the heavier horse will loosen and displace many times more tread material than either the pedestrian or biker. However, sheer numbers of any one user type can overwhelm just a few of another. The impact of one horse in a muddy area is no match for twenty hikers. Nor are a handful of hikers going through a stream comparable to ten bikers splashing across at speed. All trail users affect the trail surface and surrounding environment, especially when trails are poorly planned and constructed. The impacts are intensified when trail activities occur during fragile environmental times - such as when natural surface trails are soft (winter freeze thaw cycle, heavy or prolonged rain events). Soft trails are more susceptible to soil compaction, displacement, and erosion, or vegetation loss or trampling when users avoid puddles or soft tread areas.

The increase of knowledge and understanding of the inner workings of the natural environment and how trail activities impact and interact with local site conditions, has reshaped how the Division approaches trail planning/design, development, and maintenance. It has been the accumulation, and continuation, of this knowledge that has led to a broader and more in-depth approach to the planning process.

The basic principles of sustainable trails include the following:

- Incorporate contour trail design
- Maximize natural and cultural resource protection
- Support current and future use
- Minimize adverse effects on plant or animal life in the area
- Avoid disruption of the natural hydrology
- Minimize adverse effects on tread surface erosion or displacement
- Minimize future rerouting and long-term or recurring maintenance
- Minimize or eliminate recurring trail maintenance costs.

In essence, greater level of sustainability relates directly to water and user management. Adopting these principles ensures a more accessible and sustainable trail system for the future.

Designing a sustainable trail system requires the analysis and evaluation of the following elements and factors: cultural resources; endangered or sensitive plant and animal species; occurrence and health of native plants and animals; mature growth forests; natural drainage; topography, soils, slope and grade changes; ease of access from control points such as trailheads; user type and volume; and user safety. A sustainable trail system will offer trail users interesting experiences in varying landscapes.

Current research suggests that the most effective way to minimize the environmental effects of trail uses is to build environmentally sustainable trails. A sustainable trail balances many elements including location, expected trail use, construction methods, grade changes (grade reversals) and employing quality construction techniques and material.

Maintaining trails to be sustainable will mean that park operations may need to be conducted differently than had been in the past. Using ATVs or gators instead of trucks to access trails, or small mowers replacing large tractors with brush mowers will minimize impacts to the trail. Park volunteers are enlisted in Trail Patrols to educate visitors and help pick up small branches and other debris. Volunteers also help out by reporting downed tree locations or other unsafe trail conditions or maintenance situations that must be carried out by park staff.

#### Trail Construction and Maintenance Best Management Practices General Guidelines:

- Obtain permits or notifications first.
- Before beginning any trail construction, install necessary measures to minimize and prevent erosion.
- Stabilizing slopes, creating natural vegetation buffers, diverting runoff from exposed areas, controlling the volume and velocity of runoff, and conveying that runoff away from the construction area all serve to reduce erosion.
- Ensure low environmental impact during construction and maintenance- based on seasonal conditions, soils, slope, and vegetative cover.
- Use the proper size tool for the job.
- Minimize the amount of soil disturbance.
- Construct trails during the dry months when soil saturation and water levels are at their lowest.
- Stabilize trail construction areas.
- Install temporary erosion control measures such as hay bales before construction begins. Keep them in place and maintained during construction and remove them only after the site has been stabilized.
- Trails through wet areas should be avoided or bridged.

## Appendix D: Natural and Cultural Resources

### Natural Environment

Brandywine Creek hosts a variety of ecosystems including: wooded uplands, fresh water wetlands, open meadows, and steep stream valleys. As noted elsewhere in this plan, trails can be sources of erosion, compaction and of habitat division and disturbance. But the greatest impacts of trails upon the park's natural resources are as avenues of incursion for non-native invasive plant species into native habitats. This occurs because of the constant soil disturbance and exposure that is typical of even lightly used trails. The passing of humans, no matter whether by foot, horse, bike or maintenance vehicle, is a persistent source of seed dispersal of some of the most highly invasive plants in Delaware's forested landscapes. These plants are not just a nuisance; they can alter and degrade the local ecology. Even the cocoons (containing eggs) of invasive earthworms can be moved this way. Introduction of these invasive plants and animals are the greatest threat to intact native forest habitat throughout our park system. Regular annual monitoring (and treatment if required) is necessary along all trails: existing and abandoned.

### Cultural Landscape

Although archaeologists are not yet certain exactly when the first human occupation of Delaware took place, we can say with certainty that people were living in the area 12,000 years ago. These earliest inhabitants hunted, large game such as mastodons, mammoths, and other Pleistocene megafauna, and by gathering plant foods – both linked to resource availability. During this early period until the Historic Period, the grassland settings of the floodplain and the ecotone between the grasslands and the forests along Brandywine Creek provided an attractive setting for big game and a variety of food plants. It was in these areas during prehistoric times where small bands would have camped for short periods, especially in sheltered locations overlooking low order streams.

It now appears that maize agriculture was never an important focus for the prehistoric peoples of the Delmarva, unlike along the large rivers further inland. However, multi-family groups occupied seasonal camps allowing them to more fully exploit native foods, thus increasing the likelihood of evidence left behind. The biggest change occurred during the Historic Period. The history of Brandywine Creek area strongly reflects the agricultural and small-scale industrial heritage of northern New Castle County when European settlers established farmsteads. It is these historic farmsteads, and likely prehistoric sites that warrant investigation as they relate to trail development to ensure protection.



*Historic Landscape*

## [Appendix E: Public Demand for Trail Opportunities](#)

Trail-related activities are the number one outdoor recreation activities in Delaware to fulfill public needs and trends. These findings were documented in the 2013 - 2018 Statewide Comprehensive Outdoor Recreation Plan (SCORP), a 5-year plan outlining both the demand and need for outdoor recreation facilities. The Plan then projects facilities that will fulfill gaps in outdoor recreation opportunities that meet the public's recreational needs

In August 2011, the Division of Parks and Recreation conducted a telephone survey of Delaware residents to gather information and trends on outdoor recreation patterns and preferences as well as other information on their landscape perception. These findings are the foundation of the 2013-2018 update of the Statewide Comprehensive Outdoor Recreation Plan. For purposes of planning and projecting outdoor recreational facility needs, the State was divided into five regions for reporting. Brandywine Creek State Park falls in Region 1. Within Region 1, 73% of telephone survey respondents expected a member of their household to participate in walking or jogging; 19% participate in bicycling; 34% in hiking; 20% in mountain biking; and 12% in horseback riding. Based on a comparison of findings (from the previously published 2003-2008 SCORP), the trend for trail-related activities continues to be popular among the recreating public.

Delaware is home to diverse population centers, landscape types, and varying development patterns, regional variations in outdoor recreation needs are to be expected. However, a common thread in all regions is the need for linear facilities, such as trails, and paved pathways, that accommodate walkers, joggers, hikers, bicyclists and horse riders. These activities ranked high in every region, as well as among different ethnic groups and age categories. Therefore more linear facilities should be constructed to keep pace with the population growth and the public's participation.

The SCORP survey queried participants on several aspects of their recreational lifestyles. When asked why they participate in outdoor recreation, telephone survey respondents gave these top four answers: 1) for physical fitness, 2) for relaxation, 3) to be with family and friends, 4) to be close to nature and, 5) for mental well-being.

## [Appendix F: Minimizing Resource Impacts Utilizing Sustainable Trail Design](#)

Minimizing impacts on natural and cultural resources is critical. The intersection of recreational trails, trail use, and resource protection leads to the most effective way to minimize impacts-sustainable trail design, construction, and maintenance principles. What is a sustainable trail? Although there are many elements that determine whether a trail is sustainable, there are four main trail goals that help determine how sustainable a trail will be; resistance to erosion; fulfills the user's needs; requires little maintenance; and mitigates conflicts between different users. The more successful one is in meeting these goals, the more sustainable a trail is. By far, the biggest threats to non-paved trail sustainability are erosion and soil compaction and displacement.

Erosion is the natural process by which soil and other material is transported by wind or water. If left unchecked, erosion can quickly cause serious damage to trails and the very resources we are charged to protect. Soil compaction and displacement is a localized issue directly related to trail use that can impact a foot to several feet of trail, but can have devastating effects.

Trail erosion and soil compaction and displacement can be accelerated by seasonal conditions, weather patterns, trail use, use volume, use type, terrain, vegetative cover, and gravity to name a few. Depending on the combination of the listed conditions above, tread material susceptibility will vary. However, one can only mitigate trail erosion through the utilization of sustainable trail principles.

Sustainable trail principles work together and when applied will create contour trails that will effectively manage erosion, provide high quality low maintenance trails that are fun to use, and help to reduce environmental impact, risk, and user conflicts. The main two goals of these principles are to manage water and users. Success is measured by keeping water off the trail and users on the trail. The following is a list of the main principles of trail sustainability.

### Trail Sustainability Elements

- Trail location: along hillsides or on flat well-draining soils are best
- Trail alignment: along contours
- Trail grades: keep grades 10% or less on average on steep terrain
- Grade reversals: incorporate *frequent* drainage throughout trail system
- Outslope: slope tread toward downhill side to encourage sheet flow across trail
- Adaptive trail design: consider trail design change as soil texture, vegetation cover and other site characteristics change
- Minimize soil displacement: design must take into account type of users
- Prevent user created trails: close all unofficial trail created by users
- Maintain trails: perform regular maintenance

Trail layout and design must take into account the natural and cultural resources of the site. The highest quality habitats and sensitive cultural sites should be avoided to minimize the impact of trail construction on rare species and habitats and archaeological sites. As ongoing trail design and recreational needs intersect with protection of natural and cultural resources at the park, the problem of identification, conflict and resolution of the challenges faced has led to a more

sustainable trail system. Keeping trails dry necessitates locating trails on the steeper slopes (8% and steeper) or on flat well-draining soils whenever possible.

Reducing and minimizing trail impacts in zones of high quality habitat and archaeological sites are planning objectives. Creating a trail system that maintains stable firm tread conditions is a main objective and achieves a higher level of sustainability, yet this very objective can play differently against the balance of protecting certain natural and cultural resources. Because of this, trail planning for high quality sites must occur over no less than one growing season to observe habitat conditions in the context of planned trails and how that may relate to targeted higher protection sites. In preparing this Trail Plan, observations have occurred over several growing seasons to assess trail impacts.



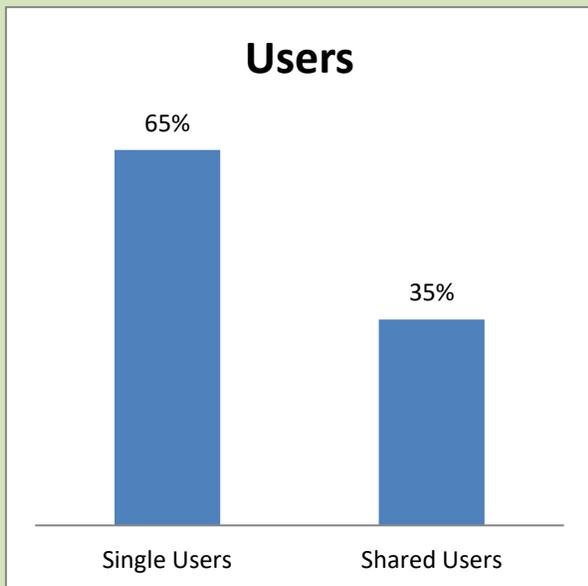
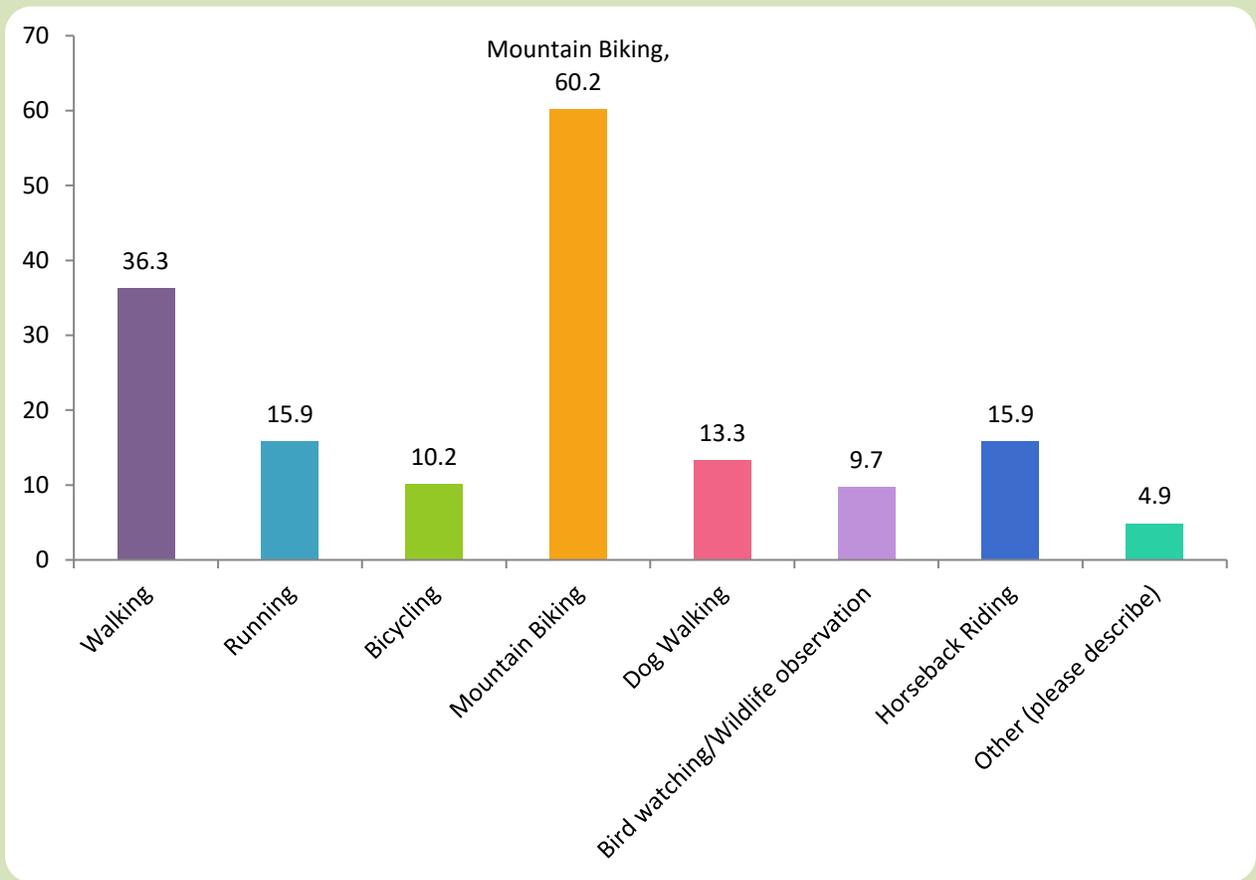
*Erosion at the Intersection of Rocky Run and Brandywine Trails*

## Appendix G: Public Comment Questions and Analysis

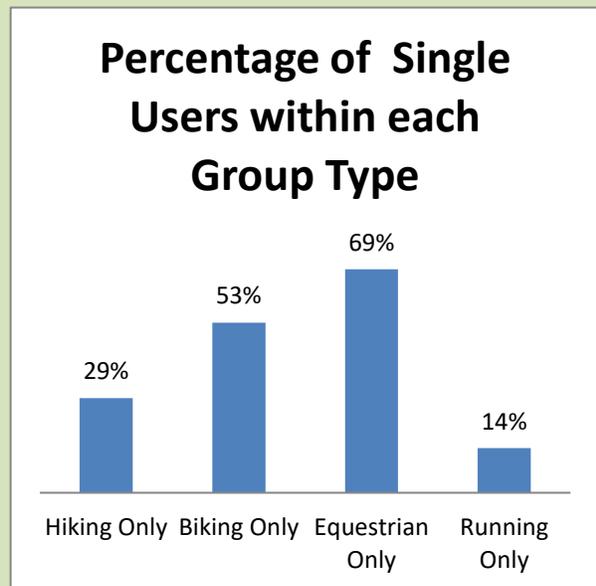
Below are the questions from the public comment form. Some questions did not provide enough data for analysis but are include here to provide a full record. In addition, comments provided were obtained by targeting local park trail users for their input.

1. Primary Use?
2. How often do you use the trails in Brandywine Creek State Park?
3. What would encourage you to use the trails at Brandywine Creek State Park?
4. What are your primary uses of the existing trails?
5. What trail amenities do you use most often?
6. Are there trail amenities that you would like to see added to the proposed trail plan? Please list the amenities and describe where you would like to see them.
7. Are there trail connections or segments that should be added or eliminated? Please explain:
8. Do you have additional comments?
9. Please provide your zip code.

## Primary Use

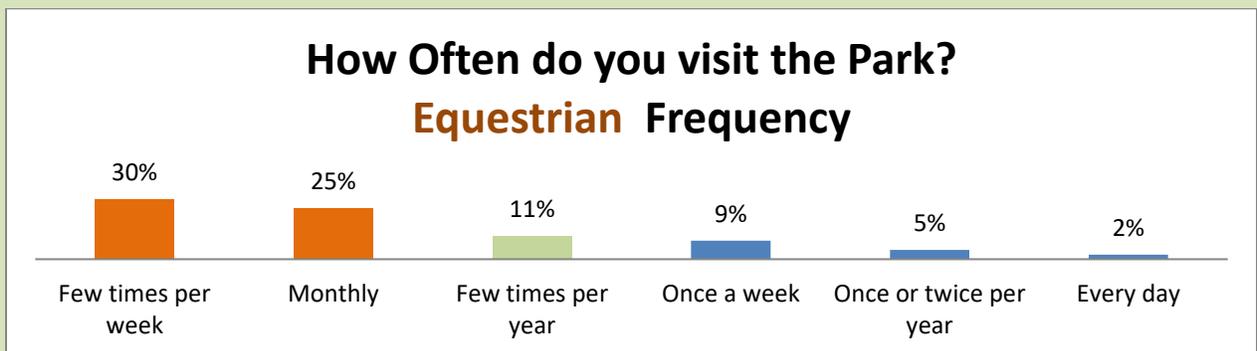
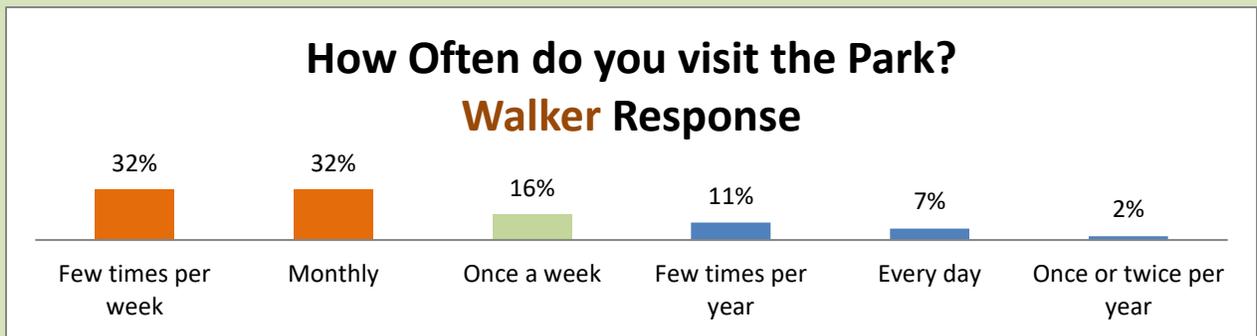
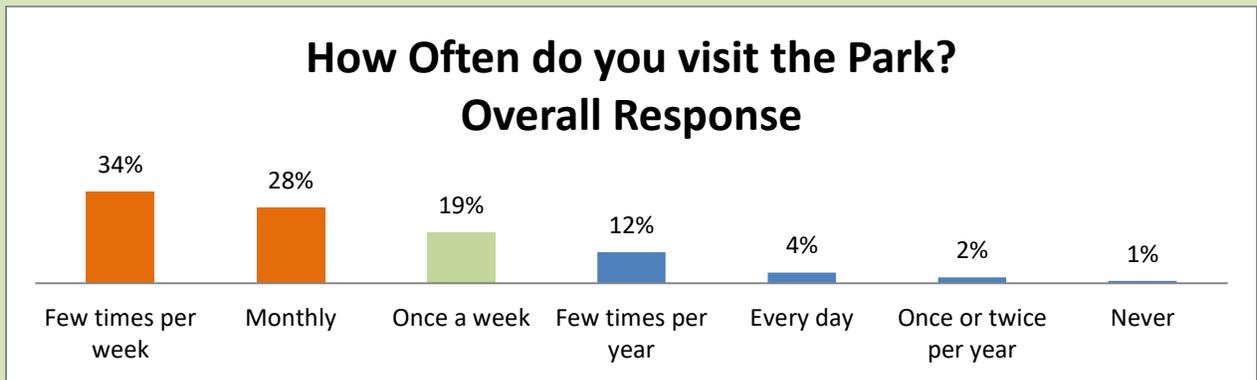


Single and Multiple Activity Users

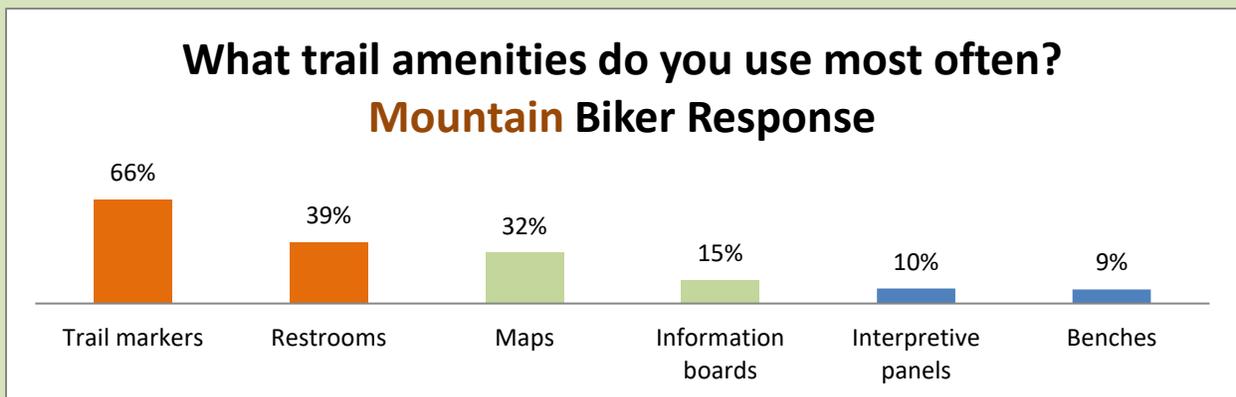
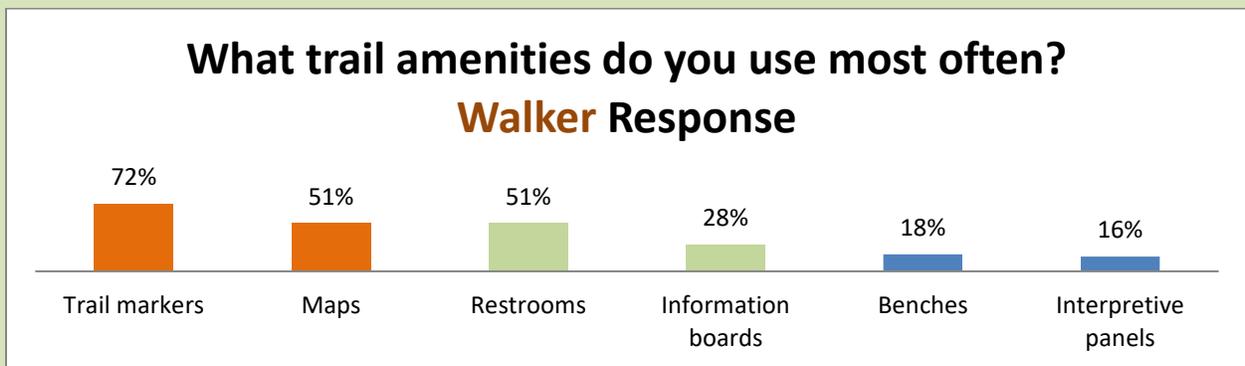
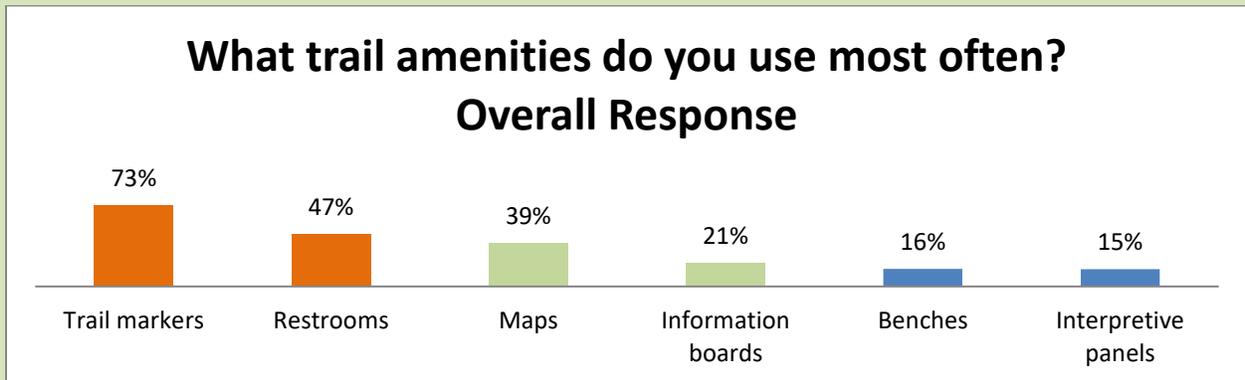


Single Users: visitors that only participate in only one type of activity

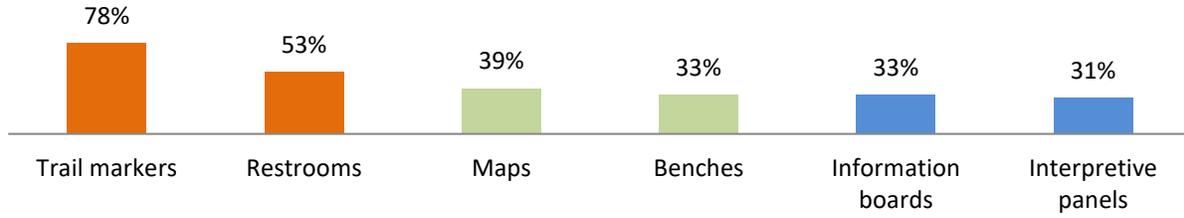
## Frequency of Use



## Trail Amenities most used

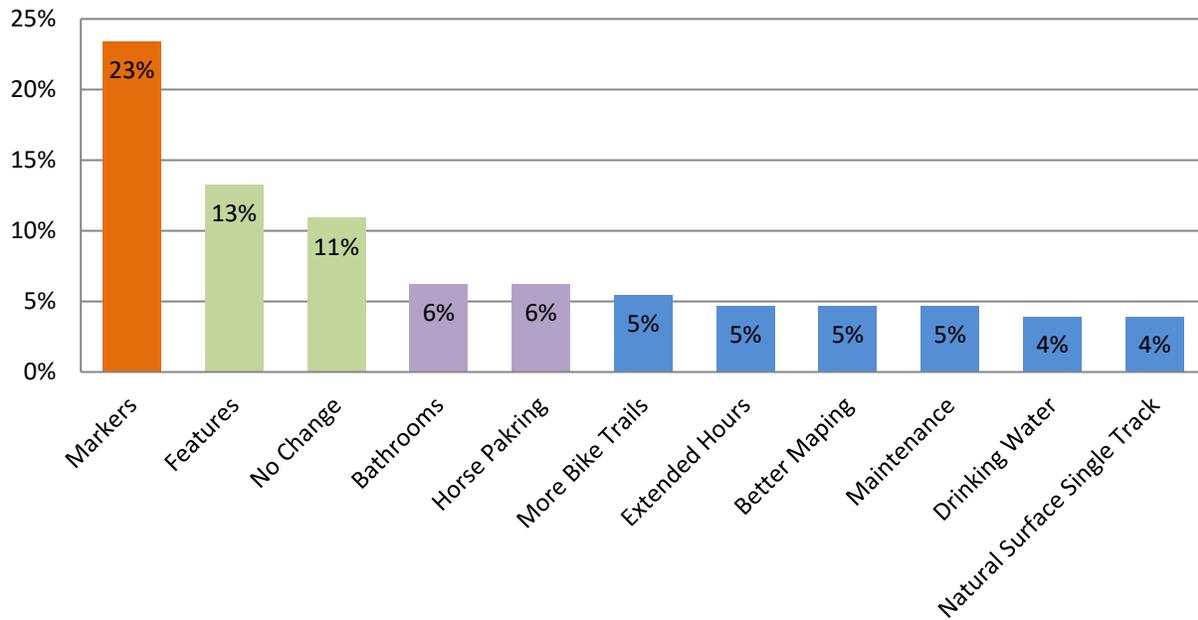


## What trail amenities do you use most often? Equestrian Response

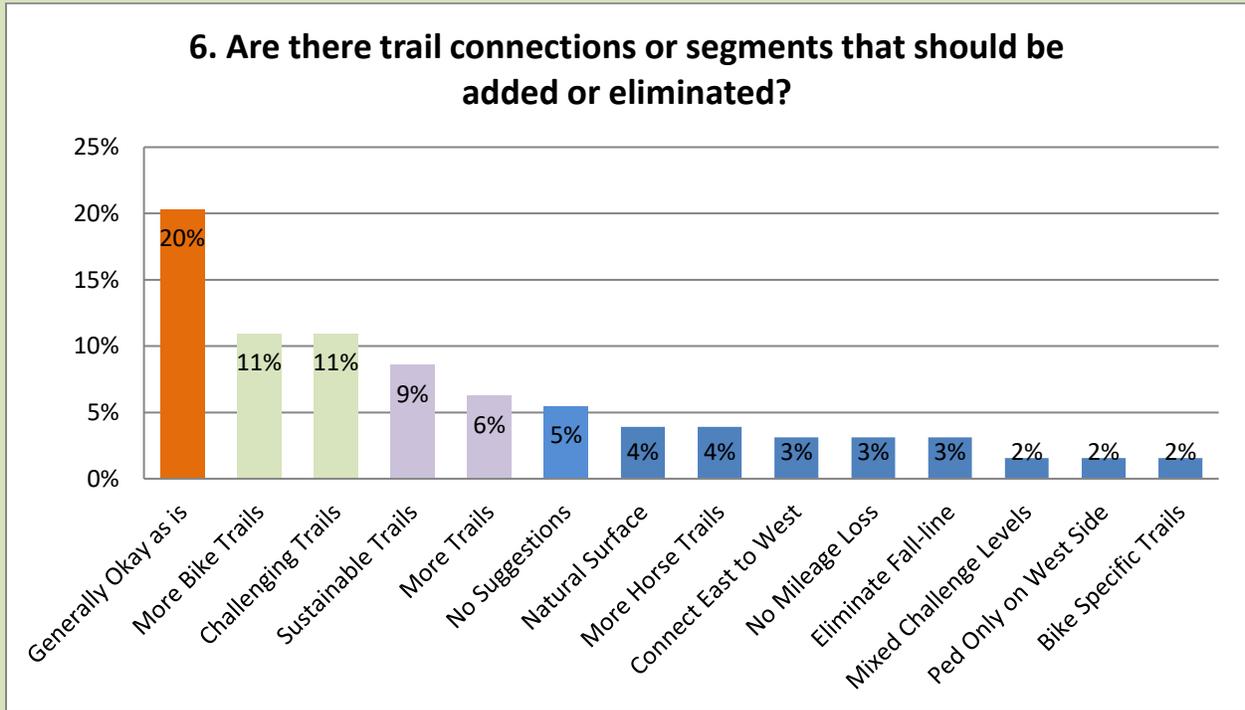


### Future Amenities most Important

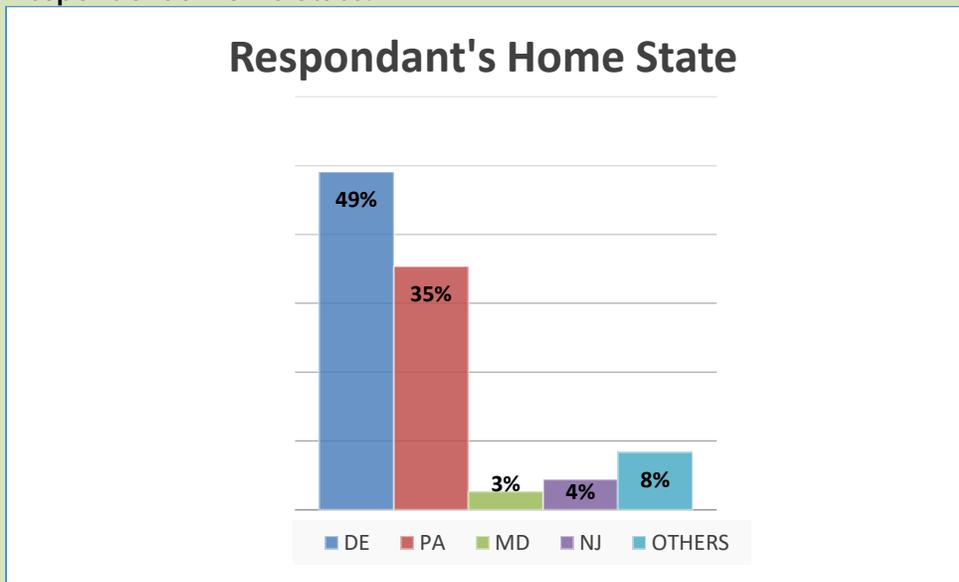
#### 5. Are there trail amenities that you would like to see added to the proposed trail plan?



Trail connections or segments that should be added or eliminated?



Respondent's Home State.



# Brandywine Creek State Park Proposed Trail Plan



## Open House - - October 28, 2015 *Comment Form*

In developing the proposed Trail Plan for Brandywine Creek State Park, the Division of Parks & Recreation has established objectives, evaluated natural and cultural resources, assessed current trail conditions, and weighed constraints and opportunities. You are invited to share observations, insights and comments on the proposed Trail Plan. The Division will further evaluate alternatives for long-term development, management, sustainability and accessibility of Brandywine's trails for current and potential new users as an integral part of a larger regional trail system. Comments you provide will be carefully assessed and evaluated in finalizing a trail plan for the park.

**1. How often do you use the trails at Brandywine Creek State Park?** (circle one)

- |  |                    |                        |
|--|--------------------|------------------------|
| Every day  | Few times a week   | Once a month           |
| Monthly  | Few times per year | Once or twice per year |
| I do not use the trails at Brandywine Creek State Park |                    |                        |

**2. What would encourage you to use the trails at Brandywine Creek State Park more frequently?**

**3. What is your primary use of the existing trails?** (circle all that apply)

- |                          |             |                                    |
|--------------------------|-------------|------------------------------------|
| Walking                  | Running     | Bicycling                          |
| Mountain Biking          | Dog walking | Wildlife observation/bird watching |
| Other (please describe): |             |                                    |

**4. What trail amenities do you use most often?** (circle all that apply)

- |                          |           |               |
|--------------------------|-----------|---------------|
| Information boards       | Maps      | Trail markers |
| Interpretive panels      | Restrooms | Benches       |
| Other (please describe): |           |               |

**5. Are there trail amenities that you would like to see added to the proposed plan? Please list and describe where you would like to see them.**

**6. Are there trail connections or segments that should be added or eliminated from the proposed plan?**

**7. Do you have additional comments?**

**Please provide your zip code:** \_\_\_\_\_

Visit the project website [www.destateparks.com/BrandywineTrailPlan](http://www.destateparks.com/BrandywineTrailPlan)

***Return Comments by November 30<sup>th</sup> to:***

Park Resource Office  
Division of Parks & Recreation  
89 Kings Highway  
Dover, DE 19901

## [Appendix H: Accomplishments](#)

Following the official closing of the public process for the Brandywine Creek State Park Trail Plan in December of 2015 there has been some improvements.

- Paving of Thompson Bridge Trailhead Parking Lot – provides more parking and accessibility
- Paving of 1700 feet of the Brandywine Trail – more sustainable and meets trail accessibility guidance
- New bridge over Rocky Run Creek – replaces failing bridge, more sustainable, and meets trail safety and accessibility guidance
- Closing of Indian Springs Trail segment and renaming and marking of Hidden Pond
- Removal of bridge 14
- Replacement of bridge 2



*New Rocky Run Bridge*

## [Appendix I: Glossary of Terms](#)

**Accessible Trail** – A trail that complies with the Americans with Disabilities Act (ADA) and follows federal accessibility guidelines.

**Bridge** – Structures used to transport trail users over obstacles like ravines, bogs, creeks, or rivers.

**Contour Trail** – A trail constructed such that it follows a contour or a constant elevation.

**Double-Track Trail** – A trail wide enough to easily allow passing or allow trail users to recreate side by side: 41” and wider.

**Drainage** – Methods of getting water off the trail.

**Economic Sustainability** – Any trail alignment that supports current and future use as it relates to the cost/benefit of that trail to the public.

**Ecoregion** – A major ecosystem defined by distinctive geography and receiving uniform solar radiation and moisture

**Erosion** – The natural process of wearing down and removing rock and soil by wind and water. One of the main processes that impact level of trail sustainability.

**Essential Experience** – A theme that is critical to the park’s story and shares the natural and cultural importance that makes each park special for visitors. The essential experiences are the landscapes, structures (natural and historic), resources, and interactions within the park that connects with the visitor to evoke passion, care, commitment, and investment to the greater good of the park as a whole, the life of the individual, and future generations to come.

**Fall line** – Direction water flows downhill (path of least resistance). A trail that runs on the fall line will channel water down the trail.

**Geographic Information System** – Software system used to display data allowing for the visualization and analyzation of that data.

**Geomorphology** – The study of the physical features of the surface of the earth and their relation to its geological structures

**Global Positioning System (GPS)** – a system used to map trails and other infrastructure locations using satellites and portable receivers.

**Habitat Fragmentation** – The emergence of discontinuities (fragmentation) in a plant or animal’s preferred environment.

**Hardening** – The manual, mechanical, or chemical action that results in a harder less erosive trail surface

**Hydric Soil** – Soil that forms under conditions of saturation, flooding, or ponding long enough during the growing season to develop anaerobic conditions in the upper part

**Percent of Grade** – The method of measuring how steep a trail or slope is. (10 percent = a rise or fall of 10 feet per 100 linear feet of trail.)

**Reroute** – new section of trail that replaces and existing section.

**Shared Use Trail** – Trails that are designed and built for more than one possible user. For example: hikers, bikers and equestrians using one trail.

**Single-Track Trail** – Trails only wide enough for travel in single file: Usually 12-36” wide.

**Single Use Trails** – Trails that are designed and built for only one intended user.

**Slope** – The natural (or created) shape of the land. Change of elevation shown on contour maps. The term is generally used to refer to the hill, not the trail.

**Social trails** – Unplanned/unauthorized trails developed informally from users and are not recognized or maintained by managing agency.

**Social Sustainability** – Any trail alignment that supports current and future use as it pertains to the public’s acceptance and use of that trail

**Sustainable Trail** – Any trail alignment that supports current and future use with minimal impact to the natural resources; does not adversely affect the plant and animal life; recognizes that pruning or removal of certain plant species may be necessary for proper maintenance; produces negligible soil loss or movement; requires little or no rerouting or minimal long-term maintenance.

**Tight and Technical** – A type of trail design that allows for tight turns, slow speeds, and can take fuller advantage of natural features.

**Trail Corridor** – Area including the tread and trim zone on either side of the tread.

**Trail Construction** – Any new trail or trail segment that is not a replacement or a reroute for an existing trail.

**Trail Maintenance** – Any routine trail work within an existing trail corridor including, but not limited to, filling ruts, holes, and low spots, de berming, nicking, vegetative management, obstacle removal. Also included are more advanced maintenance needs such as trail structure repair or replacement, resurfacing, and repairing any trail section that has been damaged by uprooted trees, erosion, or wet conditions. It also includes reroutes 50' or less that are needed to mitigate any unsustainable or climate related condition such as erosion, wet areas, steep grades, uprooted trees, etc.

**Trail Network** – A grouping of trail systems on a regional, state, national, or global scale

**Trail Reconstruction** – Any trail work within an existing trail corridor including, but not limited to, significant rebuilding, enhancing, or modifying unsustainable, failing, severely damaged, or unsafe trail segments. Also included are reroutes exceeding 50' in length needed to mitigate any unsustainable trail condition such as erosion, wet areas, steep grades, etc.

**Trail Surface** – surface of any give trail. Examples include sand, grass, dirt, stone, asphalt, and concrete.

**Trail System** – A set of connected Trails

**Trail Use** – type of recreation use designed or managed for any given trail (such as hiking, biking, equestrian, motorized, etc.).

**Trail Width** – width of a trail. Designed width often based on location, terrain constraints, and type or volume of use of a trail.

**End  
of  
Trail**